

4 THE  
LAWS OF LIFE  
AND  
ALCOHOL.

BY  
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## P R E F A C E.

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ON the 23rd of April last, I was honoured in communicating to the Medical Society of London a paper noting “The Action of Alcohol on the Human Economy, as judged by the Laws of Life.” The kind and flattering reception given to that paper, and the expressed wish of a number of the Fellows of the Society that I should do so, have induced me to publish it *in extenso*.

It was most galling to my mind, and must have been to the Medical Profession generally, when Sir James Paget, in the Hunterian Oration delivered this year at the College of Surgeons, portrayed our ignorance of the principle of life, and consequently of the laws by which it is sustained.

It was surely more humiliating when Dr. Matthews Duncan, in delivering the Hippocratic Oration to the students of the University of Edinburgh, said “Medicine is a perfect chaos,” and when the *British Medical Journal*, in a leading article, endorsed that view.

We are not responsible for the sins of our fathers, neither are we to blame for the condition in which medicine has been handed down to us. But it is a most grave reflection on the Medical Profession of to-day to hear Dr. Duncan say "that he utterly despairs of ever seeing medicine raised out of that chaos." In respectful modesty, but in conscious strength, I maintain that his fears are groundless. Medicine is and shall be a science, and shall rank in the foremost place as the most deep and stupendous of the sciences. The fact that so many centuries have failed to elaborate its hidden mysteries, proves this latter assertion.

And now it shall be elaborated, delineated, and surveyed; its beauties unearthed and mapped, and its very chaos turned into sunshine and glory. To the present generation the work is entrusted.

The most profound problem can be unlocked if the intelligent student obtain and fit the proper key. I believe that I have obtained the key which unlocks the doors that have hitherto closed and kept secret the labyrinths and mysteries of medicine. That key reveals the actuating vital principle—animal vitality or life. I submitted the definition of life, and the laws of life to the Fellows of the Society and other medical men before reading my paper. I received encouraging and approving testimonies from many of the thinking men of our Profession, and in no

instance has any objection been taken to the general truth of the whole.

A vast amount of work remains to be done. If accepted, the Medical Profession will have specially to study the action of drugs in their different doses, so as to be able to apply that action whenever needed to the cure of disease. I am fully satisfied in my own mind as to their general correctness, inasmuch as they harmonise with physiological facts and with pathology and therapeutics. The more closely I follow them, the more rapidly I cure disease. I invite all medical men to think these laws out, to note how they harmonise with, and fully explain, so many difficulties inexplicable on any other basis.

Our drugs are many, and upon each one might be written as much, perhaps, as about alcohol. That I must leave for future days and future pens, and ask my readers to judge the actions of alcohol, not only by the laws of inorganic matter, which have been too much in the ascendency with previous observers, but also by the laws of life.

T. P. LUCAS.

HERCULES BUILDINGS,  
LAMBETH, *July, 1877.*

# LIFE, AND THE LAWS OF LIFE,

AS EXHIBITED IN THE ANIMAL ECONOMY.

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1. THE combustion of coal, or disintegration into carbonic acid and water, liberates potential force; so in the tissues of the body and in the blood-circuit, the combustion of the heat-giving foods and wastes from mechanical wear and tear, together with all chemical and physical changes going on in the body, must liberate force.

2. The force evolved by the combustion of the coal is exhibited as heat, which by the medium of water and varied machinery is made available for the purposes to which it is applied; so the force evolved by the combustion of the materials in the blood-circuit, and by the friction of the solid contents in the circulation, is evolved as heat and electricity; as the blood passes slowly through the brain and nerve-centres, these centres become charged with electricity.

3. As the stomach obtains from the blood the

gastric juice wherewith to exercise its function, likewise the liver obtains the bile from the same source, so the brain and nerve-centres become charged with or obtain the nervo-electricity from the blood, and by means of the nerve-fibres this is directed to all parts of the body, and rendered available as force, the manifestation varying according to the functions of the several parts receiving it.

4. This nervo-electricity is essentially the animal life of man. It is excited by stimuli, but is also to a large degree subject to the control of the soul—apparently by medium of the cerebral hemispheres. If this organ of thought be dormant, as it may, by artificial means or otherwise, it is deprived of active vitality, the soul is during such period powerless over the mechanism by which it asserts its sway over the material. Reason and the will are in this condition dethroned. Under such circumstances severe artificial irritation or stimulus to a nerve-centre will cause the branches of nerve proceeding from such centre to act more or less violently, performing their respective functions according to the degree of stimulation exercised, and the amount of force or vitality at disposal.

5. This nervo-electricity or animal life is generated at a definite rate. By artificial means that rate may be increased, but this necessitates an increased strain, and consequently increased wear and tear of the nerve-centres. This can only last for a time and

compels a reaction, in the shape of a period of rest or lowered activity. Thus take the average, a healthy vitality can only be generated in definite proportion in a given time, dependent upon the capacity and condition of the nerve-centres, and the whole organism generally.

6. If in obedience to the dictates of the will, or by artificial means, a larger amount than natural of nervo-electricity be continuously directed to any one point, other parts must suffer a diminution, more or less, in proportion to the severity and length of the stimulation, and to the nature of the part acted upon. Thus a man cannot run at full speed and think deeply at the same time. A patient suffering from acute disease cannot expect digestive power. A fever patient may take large doses of alcohol and they may be physiologically inert. In an exhausted sensorium, exhausted consequent on severe stimulation by alcohol or other means, all the life available is instinctively directed by nature to the medulla, so as to ensure the action of the heart and lungs. This is at the expense of the centres supplying the legs, arms, abdominal viscera, and brain hemispheres. If induced naturally, by fatigue, this condition is termed sleep. If induced by toxicant drugs it is termed drunkenness. If the stimulus be severe enough to exhaust the medulla, the result is death.

7. When a nerve to a muscle is stimulated gently, currents are regularly passed, and natural muscular

contractions follow. When the stimulation is more severe the currents are passed irregularly, and unnatural spasmotic or convulsive action follows. This is caused by the abstraction of nervo-electricity, probably from the nerve-fibres themselves, and also from the centre supplying them. A period of rest is necessary in which the nerve-fibres and centres shall be recharged before stimulation can again induce manifestation of active vitality. A more severe stimulus still, or in other words shock, will so exhaust and damage the nerve and its centre as often to necessitate a lengthened period for repair and revitalisation. If the stimulus act on the viscera, or parts connected with the great sympathetic system, nervo-electricity is not only drawn from the nerve-centre first excited, but also from centre after centre, according to the degree of stimulation.

If the exhaustion or withdrawal of nervo-electricity reach to the medulla, congestion and other insuperable obstacles to life take place before the centres can recover themselves.

8. The nervo-electricity may be divided into three portions :

1st. The radiating electricity : That with which all the tissues of the body are charged. This condition enables them, especially the muscles, to answer instantaneously the impulses of the nervous centres, and to perform their several functions. This is essentially the condition of vital tissue.

Without radiating electricity the parts would become devitalised and gangrenous.

2nd. The complementary electricity, or that continuously passing down and keeping the nerve-fibres fully charged. This condition enables the afferent and efferent fibres instantaneously to pass currents to and from the nerve-centres. It also ensures that the currents shall be directed along the nerve, and not pass into the surrounding tissues.

3rd. The supplementary electricity, or that which is available to exercise as force for the performing the varied functions of vitality.

9. The functions of the body are secured and a healthy equilibrium maintained by means of two series of nerves, the cerebro-spinal and vaso-motor ; the former are essentially excitor, the latter depressor. The whole are intimately connected, especially by means of the sympathetic system, and by reflex action act and react upon each other, thus restoring when disturbed the healthy balance of the functions of life.

10. Drugs which act as direct depressants or sedatives upon the body do so by inciting to action the vaso-motor nerves. Drugs which directly stimulate or excite, do so by inciting to action the cerebro-spinal nerves.

11. A small dose of a sedative drug will tend to

lower an excited vitality, or to depress the natural condition by inducing lowered pulse, depression of spirits, rigors, cold sweats, lassitude, etc. A larger dose, which would so lower animal vitality as to seriously impede or damage the functions of life, by reflex action brings into play the cerebro-spinal nerves of the part or parts endangered, and thus we get an excitor action or fever. If a larger dose still be given, sufficient to render nil the cerebro-spinal reaction, we see the drug poisoning by its own direct, depressor, devitalising action.

12. Severe prolonged stimulation, to the cerebro-spinal system generally, produces exhaustion. This exhaustion is manifested in the lowered production of nervo-electricity. Successively the legs, arms, abdominal viscera, cerebral hemispheres and cerebellum, become inert or dormant, and all the force available is directed by nature to the medulla oblongata, which supplies the vital organs, the lungs and heart. If the stimulus be continued, death results by reason of the inaction of the heart and lungs.

13. Severe or prolonged stimulation of the cerebro-spinal nerves, by elaborating or using up the nervo-electricity available, exhausts or lowers the vitality of the said nerves, and, consequently, the vaso-motor nerves exert a greater power (the balancing power of the cerebro-spinal nerves being lowered); the result is sleep or narcotism, and in severe cases, syncope and death. This action of the vaso-motor nerves is

the result of the diminished action of the cerebro-spinal, 1st, indirectly, by reflex action; and 2nd, directly, by the action of the carbonic acid, accumulated in this condition in the blood, and which is a true narcotic.

In animals hunted to death, where the cerebro-spinal nerves of the body are completely exhausted, there is little or no rigor mortis (rigidity after death), inasmuch as the cerebro-spinal nerves have parted with their nervo-electricity, and at the same time the vaso-motor nerves have sufficient complementary electricity to keep the muscles, under such circumstances, completely relaxed, until decay sets in.

14. When the vaso-motor nerves, or a portion, are artificially stimulated to a high degree, the corresponding cerebro-spinal nerves become inert: thus in poisoning by worara, the muscles are perfectly relaxed, because the nervo-electricity has been stimulated even from the cerebro-spinal muscular nerve-fibres, and directed to the vaso-motor nerves affected. If, however, the vaso-motors be stimulated to exhaustion, the corresponding cerebro-spinal fibres exert full play; thus one of the first symptoms in prussic acid poisoning, if given in *large* doses, is rigidity of the jaws. If the vaso-motor system generally be exhausted or paralysed, the result is instantaneous rigid spasm of all the muscles, or true rigor mortis.

15. Death by exhaustion of the cerebro-spinal or

of the vaso-motor nerves rarely occurs in the higher classes of the animal kingdom, inasmuch as conditions untenable with life are brought about before the nervo-electricity is all spent. Severe exultation gives rise to inflammation of the brain and its membranes, and of the lungs: severe depression causes congestion (stagnation of blood in the small vessels) of the brain and its membranes and of the lungs, and a clotting of blood in one or other of the chambers of the heart.

It is rarely that the cerebro-spinal nerves generally are completely exhausted—the best example is an animal run to death. As a rule, the nervo-electricity, as exhibited in the rigor mortis, is many hours before it is all spent.

In insects the whole vaso-motor system may be easily paralysed by chloroform or prussic acid, the result is instantaneous rigidity of every part. In animals killed with a severe dose of a sedative or depressant poison, rigor mortis, through exhaustion of the vaso-motor nerves, rapidly follows.

16. Prolonged stimulation of the cerebro-spinal nerves produces such exhaustion as necessitates a lowered vitality. Prolonged stimulation to the vaso-motor nerves also directly induces a lowered vitality. Thus we obtain similar results in both cases, the one by indirect, the other by direct action. An irritating, tickling cough may come as the result of exhaustion after a period of exalted vitality in speaking or

otherwise; the same cough will come on from direct depression or lowered vitality, as during sleep.

17. Medicines which act upon the same system of nerves will act together if in small enough doses; but if in larger doses, they to a degree modify and lessen their own individual action, inasmuch as nervo-electricity available is not sufficient to secure the full action of each. Thus in two rabbits of one batch, the one was killed with twenty-five drops of rectified spirits of wine, the other suffered little inconvenience at the time from 193 drops of the spirits, in combination with  $\frac{1}{32}$  grain of strychnine administered within one hour. Chloroform will modify the action of prussic acid, and a gentle inhalation of chloroform by modifying the action of the poison will give the best chance for the life of the patient, provided the nervo-electricity, now more widely spread over the vaso-motors by the two sedative poisons, and therefore less tentative, be stimulated by electricity, ammonia, ether, or other means, to the cerebro-spinal, until the poison be eliminated by decomposition or chemical change by the excretory organs.

18. Medicines which act upon the different series of nerves will act together if in small enough dose, either one being insufficient to call into play all the nervo-electricity available: thus we can account for the successful combination of sedatives with drastic purges to prevent griping, the great remedial power of small doses of calomel and opium, etc. If the

two medicines given will severally exercise irritation sufficient to call into action the nerve-force available, first the one which is more powerful will act, and then the other. Thus strychnine and prussic acid in poison doses will not counteract and destroy each other, as vainly hoped, but act independently, the most potent first, and afterwards the other.

19. Poisons or diseases destroy life by exhausting or damaging the nerve-centres, or by using up too rapidly the available nervo-electricity. In exhausted or lowered vitality the circulation becomes blocked by hypostatic *congestion* of certain parts, notably the viscera. In exalted vitality there is danger of *acute inflammation* dependent on severe local stimulation, and with consequent obstruction to the free circulation of the blood. If the available vitality is insufficient, so that the nerve-centres cannot overcome the obstruction, the blood becomes imperfectly aërated, and consequently the conditions are wanting necessary to the production and maintenance of animal life.

The duration of life is regulated by the creative and dispersive activities. The latter in excess speedily induce death.

20. In the treatment of disease these points should be kept in view and enforced as far as possible:

1st. The elimination of the poison or removal of the irritating mischief.

2nd. The building up and strengthening of the

weakened nerve-centres, by the introduction of foods *which can be assimilated* by the digestive processes and made available for the repairing and strengthening the proper tissues.

3rd. The husbanding the sparks of life or strength. To do this we must carefully avoid exhausting or over-straining the nerve-centres by means of foods or medicines.

4th. The supplying plenty of pure air and light, and the keeping a proper and even temperature, and at the same time enforcing absolute rest of body and mind; that the conditions for life may be most favourable, and the rate of expenditure of life the lowest possible.

# LIFE AND THE LAWS OF LIFE,

ILLUSTRATED IN

## THE ACTION OF ALCOHOL ON THE ANIMAL ECONOMY.

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### CHAPTER I.—INTRODUCTION.

WHAT is Life? Physiologists shrink from answering the question. They cannot define the principle. They renounce as absurd the beliefs of our forefathers, that combating genii, that good and evil spirits, that angry humours, delineate the pulsations of life, the weaknesses of disease, and the still certainties of death. They renounce the absurd, but as yet they have substituted nothing in its place. They resignedly leave matters as they found them—confusion and chaos. A few have been bold enough to seek to account for the *manifestations* of life. These teach that the dynamic force or vital energy, associated with life, is generated during the manifestation

and in the parts manifesting. Thus in muscular contractions we are taught, that the power is being generated, during the contraction in the muscle-tubes, by chemical and physical changes. Hermann likens the change to that exhibited by the rapid disintegration of gunpowder. Yet however rapidly I move my hand or arm, I hear no explosion. Our streets do not resound the echoes of thunder because of the multitudes in continual motion. The contraction of the muscle-tubes by shortening and widening the same, must cause a relative change in the position of the atoms. Chemical and physiological changes undoubtedly do take place to maintain the integrity and healthy functions of the parts: and chemical and physical changes must take place because of the mechanical wear and tear. And all these changes elaborate potential energy. But this release of energy is subsequent to, and only partly parallel with, the actual manifestation of force, and certainly is inadequate to produce the amount of power displayed. But muscular contractions succeed each other so rapidly. Is there a known instance in chemical science where a compound assumes a new form and returns to the original; in other words, where the factors so rapidly, regularly, and systematically exchange and rechange places in such a brief period of time? And can physical changes to produce such an amount of force take place in the parts manifesting it, so rapidly and so repeatedly with so little waste? Although taught by great men, the theory is far-fetched.

To take an analogy, compare man to a locomotive engine. Philosophers tell us that every vibration of the mechanism passes through the entire substance, and that, consequently, each separate atom is affected. But will any be bold to say that the vibrations, acting upon the atoms, produce the manifested force; and that the heat and the steam are simply inciting agents? Yet such is practically the teaching of physiologists, when they say that physical and chemical changes in the muscle-tubes generate the dynamic force or manifested strength of man. But allow that the combustion of coal liberates conserved force as heat, and that the heat expands water into steam, and that by mechanisms specially constructed the steam is made available for purposes designed, and how simply and truly every difficulty is explained. The heat expanding the water into steam represents the force—the machinery being simply the mechanism by which the force is husbanded and made available for the various purposes intended.

So in man, the muscles and other organs are but the mechanisms by which the force is concentrated and applied for given purposes. The force itself is not directly generated by the machinery. How, then, is it generated, and where?

We read in inspiration that "The blood is the life"—the animal vitality. It contains and elaborates the life and strength of man. The stomach secretes gastric juice from the blood. The liver separates bile from the blood. The kidneys excrete urine from the blood. The heart propels the blood.

The lungs aërate the blood, and the nerve-centres must be fortified by the blood. Disintegration and chemical change take place in the blood, or in the tissues by means of the blood. Assimilation of material to the tissues of the body takes place in the blood, and in the viscera by means of the blood. A large quantity of oxygen is taken in, and a quantity of carbonic acid is given off every moment by the blood. Considering, then, all the chemical and physical changes taking place in, and in connection with, the blood, what must be the amount of force liberated, in the forms of heat and electricity ! The disintegration of one pound of coals into carbon oxide liberates so much force. What, then, must be the force elaborated daily by the changes going on in the blood ! Further, the blood contains myriads of small bodies, or corpuscles, and these in the circulation, by friction with each other and against the sides of the vessels, must be further heated and charged with electricity. We have seen that all the viscera of the body perform their functions by drawing their materials from the blood, so it is only fair to infer that the brain and nerve-centres draw the materials, subtle though they be, by which they perform their functions, from the blood. We have noted that the muscles and other parts of the animal economy do not themselves generate or elaborate the force, but are simply the mechanisms by which the force is utilised. We know, moreover, that muscular contraction never takes place, and that no force of any kind whatsoever is ever exhibited in the animal

economy, excepting at the bidding of the nerve-centres. We know that currents of electricity, artificially propelled along a nerve-fibre, will cause the part supplied by the said nerve to perform its proper function, provided only that the fibre itself is in a condition—*i.e.*, is charged with electricity—to allow the currents to pass. Electricity is liberated force, and so artificially liberated force may be passed along a nerve, and according to the mechanism receiving and utilising the force, so is the manifestation of power.

Since, then, so vast an amount of force is elaborated and stored in the blood as radiating heat and vital electricity, since the manifestation of motion is entirely dependent upon the nerve-centres, and since electricity artificially applied will, under favourable conditions, be manifest as force—it is only logical to conclude that the nerve-centres store up and become charged with the electricity or force elaborated in the circulation, as the blood flows slowly through them.\* This nervo-electricity is essentially the force or vitality or life of the body. Direct it to any point and you get the life and activity of the part manifested. Cut it off, and the machinery is motionless. To say that it is only the inciting agent, and that all the force elaborated in the blood is to no purpose, is to speak lightly of the Creator, whose

\* Further, by experiments on rabbits, monkeys, etc., Dr. Caton has demonstrated by the galvanometer and electrodes that electric currents are discharged from the brain in answer to stimulating agents.

works show such evidence of adaptation and design. It is unphilosophical to urge that the steam is not power, but simply a condition under which the engine generates the force, and it appears to be equally unscientific to say that the currents passing from the nerve-centres to all parts of the body do not represent power, but are simply the incitors of further chemical and physical changes which do produce force. The vibrations through the atoms of the engine are insufficient to produce the force displayed, and the slight and simply mechanical physical and chemical changes produced in the muscle-tubes during a contraction are far too feeble to release or exhibit as their sole production the force evolved.

The animal machinery is constructed of a certain strength, being destined as it is for a certain amount of work. There is no elaborate waste—no constructing a thirty-horse-power engine for a ten-horse-power work. And so we find that the nervo-electricity or vital energy is only available so much per minute: the quantity necessary to be distributed to all parts of the body. The amount can be increased for a time artificially, but reaction will follow, in reciprocal proportion to the healthy tone and power of the nerve-centres—to the amount and duration of the extra strain brought to bear upon them, and to the repairing or breaking-down power of the stimulating agent. Thus fresh air, sea-breezes, mountain ozone will gently stimulate, tone, and invigorate the whole system, and under these favourable circumstances nourishing food will be better assimilated, and the

nerve-centres themselves re-fortified and strengthened, so as, to the utmost of their capacity, to generate life. On the other hand, alcohol, while stimulating the system generally, will act indirectly and directly upon and, so to speak, demoralise and exhaust the nerve-centres to such a degree as to necessitate a period of rest either as a lowered vitality, or as absolute sleep.

The nerve-fibres are continuously charged with nervo-electricity, even as the Atlantic telegraph wires, and thus when the afferent nerve-fibres are irritated, the sensation is conveyed to the nerve-centres, and a current is passed with lightning speed along the efferent fibres. If the nerve-fibres are not continuously and sufficiently charged, we get pain, as cramp, neuralgia, aching, etc. There are in the animal economy two kinds of nerves, slightly differing from each other in composition—the cerebro-spinal and vaso-motor. If by means of a battery you incite the cerebro-spinal nerves to action, you get excitor phenomena, or a raised vitality: the arteries dilate, the blood-flow becomes greater in volume, glands secrete more freely. On the other hand, if you incite to action the vaso-motor nerve going to a gland, a depressor action or a lowered vitality follows: the vessels contract, the blood-flow becomes sluggish or even ceases, the gland no longer secretes. The two series act and react upon each other, and thus keep in healthy equilibrium the functions of the body—for if you cut the vaso-motor in the neck of a rabbit, the cerebro-spinal will have

increased, less curbed, sway—and the parts will increase in temperature, and an exalted vitality be produced to such a degree that that side of the neck will grow as fast again as the other. Or again, stimulate both cerebro-spinal and vaso-motor nerves going to a gland, and the effect will be neutral.

Now certain drugs, as alcohol, camphor, ammonia, cayenne, the mineral compounds, bitter and aromatic herbs, etc., stimulate locally or generally and cause an excitor or increased vital action: Another class, as opium, chloroform, aconite, prussic acid, chloral hydrate, belladonna, stramonium, tobacco, etc., produce a depressor or sedative action. Now, if galvanism produce excitor symptoms by acting upon the cerebro-spinal nerves, why should not those drugs which produce the same excitor phenomena produce them by the same means? and if galvanism depress and lower vitality by acting on the vaso-motor nerves, why should not those drugs which produce similar depressor phenomena, also do so by direct action on the vaso-motor nerves? Thus I reason, and I maintain philosophically, stimulants act by exciting locally or generally the cerebro-spinal nerves; sedatives act by exciting locally or generally the vaso-motor nerves. The intimate connection between the two series of nerves, specially in the great sympathetic system, their reflex action on each other, and their province so to act upon each other as to keep as far as possible the functions of the body in a healthy equilibrium, explains the apparently contradictory phenomena produced by a single drug, and which has hitherto puzzled physiologists. They call

a drug, as opium or chloroform, a tonic, a stimulant, a sedative, and a narcotic, according to the dose exhibited. Such logic is not philosophical or in accordance with law. Examine the question by the laws I have sketched. Give a small dose of a sedative or lowering drug, and the pulse falls, cold creeps, rigors and general lassitude and depression follow. Give larger doses, such as would seriously depress and interfere with the healthy performance of the functions of life, and by reflex action—because of the intimate connection between the two series of nerves—the cerebro-spinal nerves are stimulated to throw off the poison, hence we get excitor, fever symptoms manifested. (The absorption of  $\frac{m}{ii}$  of tincture of aconite through the mucous membrane of the gums, caused my pulse, in a very few minutes, to run up to 112, which condition lasted for at least an hour, until the tingling sensation of the poison had left the mouth.) Give a larger dose still of the sedative drug, such as shall overcome the cerebro-spinal influence, and act in spite of nature's efforts to the contrary, and we get true sedative poisoning, and death by coma.

Again, a drug which acts on the cerebro-spinal nerve of a part, tones, stimulates, and inflames, according to the dose given: or if it be a general stimulant, it tones, stimulates, and exhausts. This exhaustion is termed drunkenness and narcotism. And here I must point out that many members of the profession have committed a grave error in mistaking a physical condition for a special characteristic

physiological action of a drug. Dr. Corfield tells us that alcohol cannot be a stimulant, because it is a narcotic. Many others say it is a stimulant in small and a narcotic in large doses. The term narcotic is derived from the Greek *ναρκω*, to render torpid, to produce sleep. Now sedatives, as opium, do directly produce sleep, and so in powerful enough doses are true narcotics. But stimulating drugs, such as alcohol, are not sedatives. They stimulate until they exhaust the nervo-electricity, and reduce it to such a low ebb as naturally necessitates sleep.

Nature is only built for a certain amount of work, and a day's work tires out and exhausts the cerebro-spinal nerve-centres to a certain point, beyond which it would be a serious matter to prolong the strain. By indirect and reflex action, as the cerebro-spinal nerves lose power, the vaso-motors would appear to induce sleep. The carbonic acid in the blood is increased—the nervo-electricity is withdrawn from the brain hemispheres. The blood-flow is lowered, and nature asleep has opportunity to resuscitate and re-fortify her batteries ready for the approaching day. Alcohol does the same thing as a day's work, only in a very much shorter period of time. It exhausts, and exhausted nature, to avoid fatal consequences, sleeps. If such a provision were not made, the recklessness of man in persisting to take the drug would always end in death. Thus drunkenness or narcotism is simply a physical condition—a reaction induced by nature to save the man from the consequences of his own folly. All general stimulants

will produce the same exhaustion which necessitates sleep. Camphor, ammonia, strychnine, sulphurous ether, all lead to drunkenness and narcotism. But as hard work is not a true direct narcotic, neither are those stimulants which lead to the same physical condition by exhausting and lowering the animal economy.

In the true sense of the term, alcohol cannot be a narcotic. Sedative drugs are direct narcotics. The general stimulants produce by exhaustion such a physical condition as necessitates sleep, but they do not themselves produce the narcotism. In a word, if nature could bear it, if the supply of nervo-electricity were unceasing and indefinite, sleep would never follow the exhibition of stimulants. Unless the term narcotic be thus restricted to agents directly producing narcotism, it will be of no value as a therapeutic term. It must simply indicate a drug potent enough to poison. All potent drugs, and the simple tonics in connection with alcohol, *i.e.* as tinctures, either directly narcotise, or stimulate to exhaustion, a physical condition impossible with active vitality. And further, all these drugs, if pushed far enough, will poison, so that unless the term narcotic be restricted to denote a characteristic action of a particular class of drugs, the two terms, narcotic and poison, will simply be synonymous.

In the correct sense of the term, alcohol cannot be a narcotic. As we have seen, the first symptoms of sedative or true narcotic poisoning are lowered circulation, cold creeps, rigors, cold sweats, and lassitude

and general depression. But nothing of the kind takes place from drinking alcohol. It may be urged that the medium doses, by reflex action, cause a stimulant reaction ; but where do we see the depressor effects of small doses ; where, until exhaustion has set in, do we see narcotic symptoms at all ? It must be at once evident to the unprejudiced observer that alcohol is not a narcotic.

We will consider :

I. Alcohol as a chemical agent, its combustion.

II. Alcohol as a physical agent in precipitating albumen.

III. Alcohol, its oxidation and action on the blood-corpuscles.

IV. The direct physiological action of alcohol on the parts of the alimentary canal with which it comes into contact—the mouth, oesophagus, stomach and upper bowel.

V. The reflex and direct action on the general circulation.

VI. The direct action on the nerve-tract.

VII. Its claim as a food.

VIII. And lastly, its application as a medicinal agent.

*I. Alcohol as a chemical agent.*

When I first studied the question I was biased against the view that alcohol burned off in the system, believing that the acknowledging such would damage the temperance cause, by making alcohol a food. But I am bound to receive facts, and I am fully satisfied myself and convinced that alcohol does burn,

or is oxidised in the body, and that Dr. Anstie and Dupré's conclusions are correct, because of the following reasons :

1. As I pointed out in a previous essay, unless given in very large quantities, it cannot be re-collected in any appreciable amount from the breath, sweat, urine or faeces. If given in large quantities, so as to become a large percentage of the volume of the blood, a portion passes off mechanically with the urine, etc., and so may be again collected.
2. If eliminated mechanically, it would seriously damage the kidneys or other eliminating organs, producing acute inflammation or chronic congestion.
3. There is an increase of carbonic acid in the blood of drinkers, which, though partially to be explained by other causes, appears to be to an extent attributable to the splitting up of alcohol into carbonic acid and water.
4. Alcohol has a great affinity for oxygen, a spirit-lamp, as we all know, lighting much more easily than an oil-lamp.
5. In the absence of food, alcohol will, for a short time, maintain combustion in the body.
6. In the presence of alcohol the supply of oxygen being to a great degree limited, and alcohol having so great an affinity for the oxygen, the fats or natural elements for combustion to a great degree remain unused, and are mechanically suspended in the blood, and laid up in the soft parts, causing fatty degeneration, especially of the heart and liver. This could not be the case if alcohol did not itself unite

with the oxygen, and so render the fats, for the most part, superfluous. Nursing mothers take alcohol to make milk, and the increase is doubtless to be explained on this theory, that the fats of the food not naturally consumed, are thrown off by nature into the milk, the bulk of which is increased at the same time because of the quantity of liquid drunk, and because of the stimulating action of the alcohol. Some time ago I attended a woman, and from circumstantial and other evidence, refused to give a certificate, believing her to have died from neglect and starvation. She was in receipt of parish pay, ate very little, but managed by various means to get quantities of gin, which she drank. A *post-mortem* examination was made on the body, when a most curious condition was met with. The muscles were as thin as in any case of starvation, almost like ribands, but were enveloped in thick layers of fat. The coats of the stomach were separated by layers of fat. The mesentery of the bowel was one mass of fat. In a word, the woman was nearly all fat, with little muscle or elasticity in the tissues. The only wonder was how life existed so long in such a skeleton. Dr. Richardson objects to the elimination of alcohol by combustion, and believes it to be eliminated from the liver with the bile. But if stored up in the liver, it would affect this organ more quickly and severely than it does; and it would affect other organs less than it really does,

It would likewise, when eliminated with the bile, materially influence the peristaltic action of the

bowel, causing congestion, exhaustion, and constipation. Then if eliminated in this way, it would be found in large quantity in the fæces, which physiologists have hitherto been unable to demonstrate. But the bile is largely reabsorbed into the blood, and naturally the alcohol would mechanically pass with it, and so be again and again eliminated and reabsorbed, not a very philosophical way of getting rid of the poison. Dr. Richardson explains the thickening of the liver by stating that the alcohol abstracts water from it, because of its great affinity for water, and that consequently the viscus is thickened. Alcohol, unless greatly diluted, does certainly abstract water from the tissues, taking it from the mucous membrane of the alimentary canal as it passes, and giving rise to the heat and dryness so dangerous to the imbiber. It is absorbed into the blood from the stomach and upper bowel, and so gets as much water as it needs from the main supply. It cannot be any more than a theory to say it absorbs water from the liver, as it is so diluted in the blood before ever it reaches the liver, as to be incapable of so acting. Further, if it did absorb water from the liver, we should expect wasting, dryness and shrinking, and not enlargement, as the doctor urges.

7. Alcohol in ale and wine will, under favourable circumstances, undergo a further ferment, passing into vinegar, carbonic acid and water. The same ferment often follows the drinking of beer or wine in weak stomachs.

8. When alcohol is imbibed, the temperature of

the body is first raised 1° to 2°, and then lowered according to circumstances, 1° to 5°. This has not hitherto been satisfactorily explained. It appears to be owing to two causes: *a.* The lower substituted for the higher combustion; *b.* The exhaustion of nervous energy or nerve force, and consequently a lowered succeeding to an exalted vitality. According to Liebig, it takes 266 parts of spirits (56 per cent. alcohol) to give as much heat as 100 parts of fat. In the animal economy a definite amount of oxygen is inspired periodically. This is increased, the circulating and respiratory functions are excited by alcohol, for a short time; but even this increase of available oxygen is not sufficient to keep up alcoholic combustion, nor even a joint alcoholic and fat combustion equal to give the natural temperature. If it were not for the lower rate of heat elaborated, and the exhaustive tendency of the drug, the body heat would be increased, even as in running; and remain high as long as alcohol is in the blood. In a strong man, used to drinking, the temperature rises or remains normal, until exhaustion or intoxication sets in, and in all cases, the temperature rises and falls in proportion to the excitability and physical condition of the drinker.

9. Persons taking alcohol, and especially spirits, lose their appetite for starchy and fat foods. Nature no longer requires them to such a degreee, her machinery being otherwise and artificially employed. The appetite for nitrogenous foods is also lost, as the

drinker lives in a lowered vitality, and needs not the food to generate energy.

10. If alcohol were not eliminated by combustion, the taking it in large quantities would be certain death. Strychnine, prussic acid, and other toxicant drugs kill because they cannot be eliminated from the system before conditions are induced incongruous with life. Chloroform, sulphurous ether, nitrous oxide, and similar poisons intoxicate for a brief period, because they are rapidly eliminated from the system. Thus we see if alcohol were rapidly eliminated, the drunkenness would be transient, if it were not as rapidly as possible eliminated by combustion, death would be the result.

11. All the arguments which can be urged against the combustion of alcohol, can be urged against that of sugars and fats. All negative and presumptive evidence strongly support the theory in both cases. And although neither may receive ocular demonstration, the facts may be proved by deductive philosophy.

Thus, examined impartially and from every point, the evidence most conclusively proves that alcohol, when taken into the system, is eliminated by combustion.

II. Alcohol as a physical or chemical agent precipitates albumen. Dr. Brunton suggests, and probably correctly, that it does so by abstracting water. Some authors contend that it precipitates the pepsin in the stomach, while others deny it. On the above explanation, doubtless both are right. In large

and concentrated doses it probably does precipitate the pepsin with which it comes into contact; but small and diluted doses exert little or no influence; moreover the precipitated pepsin is again soluble in water. The mere imbibing alcohol does not precipitate the albumen of the tissues, but if spirits be held for a time in the mouth or kept locally applied to any mucous membrane, it will precipitate the albumen of the part affected to such a degree as to render it quite pale and whitish. It is difficult to agree with Dr. Brunton in his comparison between alcohol and hot iron as escharotics, or between alcohol and catechu, kino, etc., as astringents. The doctor compares the burning sensation produced by alcohol on mucous membranes, etc., to that produced by hot metal or corrosive sublimate with the difference that the one is transitory, the other permanent. He evidently considers the burning as purely corrosive, for he says, "the direct physical action of alcohol on the tissues is not due to the warmth of the blood, for water at a temperature much above that of the blood produces no such feeling in the mouth. But warm water, and quiescent in the mouth, and the consequent relaxed condition of the tissues to which it would lead, is very different to the rapid flow of hot blood in distended and heated vessels induced by the direct physiological action of the alcohol on the nerves of the part." Dr. Brunton allows in other parts that alcohol drives increased flow of blood to the skin, which it warms for a short time—to the stomach, where it causes a flow of gastric juice—why, then,

should he deny the same thing locally in the mouth ? How does it, physically or chemically, make the mouth red ? It is easy to see how it makes the part white by precipitating albumen—but how should it redden and inflame except by causing increased flow of blood by direct nerve action ? And this is the way in which escharotics themselves act, short of destructive power. They stimulate the part—they inflame the part—they precipitate albumen, and if in powerful enough dose, they break down the tissues. The albumen precipitated by alcohol is soluble in water, that precipitated by escharotics cannot thus be again dissolved. Alcohol moreover does not break down and corrode the tissues—therefore it is in no sense of the word an escharotic. If you apply alcohol to a severe cut, it precipitates the albumen as far as it soaks in, and probably devitalises the nerve ends with which it comes into contact, forming at once a protecting shield under which the living parts can heal, and at the same time removing the irritation caused by the exposed nerve filaments. It would appear that this might be turned to practical value in major surgical operations and answer equally as well as carbolic oil and Professor Lister's dressings, especially if combined with salt, which staunches the blood and acts as an antiseptic. Dr. Brunton infers that catechu, kino, and other astringents, act by precipitating albumen, and that brandy in diarrhoea is thus often effective. The argument is somewhat ingenious, but will not bear scrutiny. 1st. It requires a very large amount of oak bark or tannin or catechu

to precipitate the albumen in animal tissues; more than practitioners would care to give.\* 2nd. If it were merely physical action the drug would act without respect of parts, upon that part first with which it would first come into contact. Thus the mouth, oesophagus, stomach, and upper bowel, would all be to a degree tanned, or their albumen precipitated before the drug reached the lower bowel, and yet the lower bowel is often the part to be relieved. 3rd. The precipitation of the albumen, not resolvable in water, would destroy the peristaltic action and in fact all vitality of the alimentary canal. 4th. Brandy will not always immediately relieve diarrhoea; if the albumen ought to this end to be precipitated, then larger and more frequent doses should be given, until the disease be arrested by the strong hand of Science.† Practice will not confirm this theory. But allow that astringents act specially by toning the nerve-filaments supplying the muscular fibres, even as pungent tastes stimulate certain filaments of the glosso-pharyngeal nerves and that thus the unstriped muscles, previously relaxed and weak, become more firm and strong, and the renewed vitality is explained. Allow that in atonic diarrhoea a dose of brandy may cure by increased general and local stimulation for a short time, but that if it fail at first, that further doses only increase the mischief by exhausting the system generally, and

\* It takes seven years to tan a hide with oak bark.

† The brandy should be given as an enema, as given by the mouth it never reaches the bowel. The theory proves too much to be true.

that in all cases a more local stimulant, as camphor or corrosive sublimate, would be preferable and more reliable and the whole is more easily and simply explained than by assuming mere physical or chemical action. The corrosive sublimate mentioned by Dr. Ringer and so largely used by the homœopaths before him, confirms this view. It is a special stimulant to the bowel, in small doses (as  $\frac{m}{i}$  of the Liq. Hydrarg. perchlor. B. P.) it tones, and so is useful in atonic diarrhœa: in larger doses it stimulates even to inflammation, and in larger still, ulceration: of course the concomitant of these conditions is sickness, diarrhœa, etc. And here the homœopaths are wrong. Corrosive sublimate in small doses will cure atonic diarrhœa, but as far as it does act independently, it will not cure inflammatory active diarrhœa, such as large doses of the drug would produce. Certainly no one will contend that minim doses cure diarrhœa by tanning. It must be by direct stimulus to the nerves. Thus it would appear that the action of alcohol as a precipitater of albumen is too insignificant to affect its action on the tissues of the body, and in the blood circuit it holds such a small percentage as certainly not to precipitate the fibrin there.

III. The chemical action of alcohol on the blood. Naturally chemical change is always taking place in the blood. During inspiration the oxygen of the air combines with the haemoglobin of the corpuscle and renders it a bright scarlet colour. In the capillary circulation the corpuscle parts with this oxygen and again becomes of a dark crimson or red-black. The

oxygen thus liberated serves two purposes ; first, it helps to build up tissues, and second, by direct union it carries off the wastes, and does its part in keeping up the body heat. The carbonic acid is suspended in the liquor sanguinis. Dr. Harley made some experiments which he communicated to the Royal Society (see Proceedings, March 15 ; vol. xiii., 1864), but which, to say the least, are very unsatisfactory. He took blood fresh from an animal and allowed it to remain for some time in contact with air. He found that venous blood yielded more carbonic acid and absorbed more oxygen than arterial. That motion increased these changes—that temperature up to 38° C. (animal heat) was more effectual the higher the degree, and that at 0° C. all change ceased. He found that old putrid blood takes up more oxygen and gives off more carbonic acid, but not in proportion ; and lastly, that alcohol acted as chloroform, only more feebly, in diminishing the power of the constituents of the blood to unite with oxygen or to give off carbonic acid. These experiments are defective inasmuch as the conditions differed—the blood in circulation and under laws of life, and the blood taken from the body and at rest.

Artificial agitation would not represent the blood in circulation. Further the doctor's greatest success was with blood putrid and decayed, plainly showing the experiments to be chemical rather than physiological. We are not told the quantity of alcohol mixed with the blood, which was probably high and not likely to be imitated in the body. Dr. Brunton

builds up quite a theory on these experiments, but is obliged to strain a point to make out his case. He says that alcohol lessens "the power of the red corpuscles to give off oxygen and must consequently more or less diminish the oxidation of the tissues." He does not tell us that probably such a thing never happens to the extent to produce any very appreciable effect in the circulation. Few drink enough for alcohol to form ( $2\frac{1}{2}$  oz.) 1 per cent. of the blood, and he must indeed be stronger than ordinary mortals to take 3 or 4 per cent. ( $7\frac{1}{2}$  to 10 ozs., nearly a pint of brandy) at a draught. What proof have we that even a 3 or 4 per cent. alcohol solution is going to alter the corpuscles as seriously as we are asked to suppose? The doctor himself remarks,\* "this effect is to some extent counteracted, or even more than counteracted, by the action of alcohol in accelerating the circulation;" and yet he says, "this power of alcohol to lessen oxidation, increases the value which its other properties give it in the treatment of febrile diseases, where oxidation is going on too quickly, and rapidly destroying the tissues." "Firstly, it will impede oxidation, and secondly, by thus lessening the temperature it will diminish tissue-disintegration." Now if its effect, supposing there to be any such in this direction, be more than counterbalanced by the rapidity of the circulation, that is if the effect be rendered nil, how can we yet have the effects of the effect? Alcohol does assuredly lower the tempe-

\* *Practitioner*, Feb., 1876, pp. 122, 123.

rature of the body, but by other means, and so produces a physical condition in which the waste of tissue decreases. It must itself abstract oxygen from the blood volume, but whether it abstracts more than the natural fats and sugars would do, is not determined. If it prevent the aeration of tissues, it surely tends to add poison to the system by preventing the elimination of the fever and other virus.

If it prevent the corpuscles giving off oxygen, it certainly prevents them taking it in, for how dusky and dark is the blood of drinkers, and this cannot surely tend to give life to the exhausted fever patient.

The physical conditions induced by alcohol—1st, the exalted circulation, and 2nd, an exhausted vitality—doubtless tend to interfere with the aeration of the blood more than the physical action of small quantities. Exhausted vitality means imperfect circulation, imperfect aeration, imperfect oxidation, and increase of carbonic acid in the blood.

It certainly is not proved that alcohol so materially affects the corpuscles as to lower the temperature so many degrees, or that such, if it were the case, would be beneficial to the patient.

**IV.** The direct physiological action of alcohol on the parts of the alimentary canal with which it comes into contact.

As remarked before, alcohol has a great affinity for water, and if it be given, excepting greatly diluted, it will absorb water from the mouth and alimentary canal in passing. The result is a dryness and burning, and the pouring out a viscid ropey phlegm, or a

white froth, according to the strength and quantity taken.\* If diluted with water, it causes a redness of the mucous membrane of the alimentary canal with which it comes into contact. By its direct action on the nerves supplying these parts it causes an increased flow of blood and an increase in the functions of the parts themselves. The alcohol, unless taken in very large quantity, is in a few minutes absorbed into the general circulation. Its action on the alimentary canal then rapidly diminishes, and as it stimulates the nervo-electricity elsewhere, it withdraws it from the stomach.

Dr. Brunton describes the action of alcohol upon the stomach.† He tells us that the pale mucous membrane "becomes of a rosy red colour, its glands begin to secrete copiously, beads of gastric juice stand upon its surface, become larger and larger until they can no longer preserve their form, when they coalesce and run down together in a little stream. This creates an appetite, and the patient suffering from exhaustion and nausea, will sit down and eat a good dinner." But is the filling the stomach with a good dinner the scientific remedy for atony of the organ and indigestion? If so, then the end is answered, and alcohol is the specific for dyspepsia.

\* This is the dryness and burning which forces alcohol-drinkers to crave for more. They cannot resist the burning thirst which, as a disease, torments them night and day. In such cases the pharynx is covered with a dark red purplish flush, a sure sign of severe nervous dyspepsia.

† *Practitioner*, January and February, 1876.

And undoubtedly, if it acted upon the stomach only, such would be the result, provided that the medical attendant could ensure doses to be given, devoid of adulteration and too weak to cause the flow of mucus. But this bright picture given by Dr. Brunton is greatly at fault with that drawn by Dr. Beaumont, as seen by him in the stomach of Alexis St. Martin. He says, "In febrile conditions of the system, occasioned by whatever cause—undue excitement by stimulating liquors, overloading the stomach with food—the villous coat becomes red and dry, at other times pale and moist, and loses its smooth and healthy appearance: the secretions become vitiated, greatly diminished, or even suppressed; the coat of mucus scarcely perceptible, the follicles flat and flaccid, with secretions insufficient to prevent the papillæ from irritation." He also describes pimples, red and purulent, irregular circumscribed patches, aphthous crusts, and abrasion of the lining membrane. When these symptoms are accompanied by "dryness of the mouth, thirst, accelerated pulse, etc.—no gastric juice can be extracted by the alimentary stimulus."

Dr. Brunton recommends the nip of brandy or the glass of fortified wine to create the appetite, and this may be so far successful as to fill the stomach with foods indigestible or otherwise, according to the wisdom or the whims of the individual. A certain amount of gastric juice may be at first poured out, but, as shown by Dr. Beaumont, and as a natural result, this is by no means certain in habitual

drinkers or in the debilitated and diseased. But in the most favourable cases, the flow of gastric juice soon diminishes, inasmuch as the alcohol is absorbed into the circulation, and unless the stimulus of the food be very much greater than that of the alcohol on other parts, the flow must almost of necessity cease—at all events the nervo-electricity is largely withdrawn from the stomach and directed elsewhere by the alcohol.\* Thus we get an overloaded stomach with little or no power of digestion. The food now acts as an irritant, and together with the previous action of the alcohol, causes a dryness of the mucous membrane of the stomach and an exudation of mucus, which acts as a ferment, and together with the undigested foods, causes rising of noxious gases and wind. This comes up through the cesophagus, which is also dry and heated, and causes the disagreeable odour mixing with the breath of drinkers. In this condition the fluids in the stomach are often so highly acid and acrid as to give rise to vomiting and ridding the stomach of the offending contents. Absorbed into the circulation, they become blood poisons, and often give rise to an irritating skin rash,

\* True, a severe stimulus as alcohol may cause the gastric glands to pour out their gastric juice in a comparatively short time: but this is a disadvantage. 1st, the gastric juice thus poured out is not slowly mixed and diluted with the food. 2nd, when the glands give up all their gastric juice suddenly, a lengthened period must elapse before a fresh and healthy supply can be generated; if the glands are continuously stimulated, they will either fail to respond, or they will pour out a vitiated fermentative fluid.

simulating measles, as well as to rheumatism, gout, and other concomitant symptoms of dyspepsia. In a bilious person, the continued stimulation and irritation to the stomach produces exhaustion of the brain hemispheres, and consequent megrim and sick headache. In others, it produces slight feverishness, dry, furred tongue, congestive headache and general lassitude, and exhaustion.

Again, the habitual use of alcohol exhausts and weakens the brain and nerve centres. If previously weak from this or any other severe strain, a meal of indigestible food, accompanied by moderate drinking of alcoholic liquors, will so severely irritate the stomach as often to cause sickness, tingling in the hands and legs, numbness and paralysis, giddiness, and other signs premonitory of epilepsy. Unless the stomach be quickly relieved, the irritation is so severe that by reflex action it affects the whole sensorium, and throws the frame into strong convulsions. The exhaustive action of the alcohol on the already weak nerve-centres, and the irritation of the food on the stomach, at length so weakens the medulla itself, that congestion of the lungs and futile action of the heart soon end in death. Death may also result from the bursting of a vessel, or effusion on to the brain, through the excessive strain in vomiting, or from direct alcoholic blood pressure on the resisting arterioles and capillaries.

*Ex. 1.* A patient, a woman about forty-eight years of age, weakly and depressed through anxiety and grief, took a glass of porter on an empty stomach.

In a few minutes she fell back into a chair, became insensible, and almost paralysed on one side. She vomited a dark-coloured fluid with a quantity of viscid mucus and phlegm. The mouth was very clammy, dry, and parched, excepting as she foamed and vomited the viscid mucus from the stomach. Strong purgatives and an enema failed to act on the bowels—sinapisms were useless, and she died in some ten hours after the attack. All the symptoms pointed to serous apoplexy.

If alcohol be good for the stomach, surely the above was a case in point. A woman of exemplary character, most moderate drinker, and suffering from exhaustion and indigestion, ate no breakfast through lack of appetite. She took only the one glass of porter about mid-day, and instead of an appetite and strength, she suffered the penalty in sickness, exhaustion and death.

#### GIN AND BACON.

No. 2. A woman, aged 37 years, had been a gin-drinker for some time, but to the best of my information not a drunkard. She took some in the morning (half-a-quartern) and ate a hearty dinner of bacon, etc. She was seized with a succession of epileptic fits. Sickness and diarrhoea partially relieved her. The spirits were cut off, the stomach cleared, iron and strychnine given, and the fits ceased. For some time she suffered from exhaustion and slight hemiplegia, accompanied by spasmodic twitches of the muscles. She complained very much

of painful creeps or sensations running round the thigh and lower portion of abdomen, which appeared to be connected with an old wound of the perinæum. Gentle exercise relieved whenever they troubled her. All these symptoms show terrible nerve exhaustion, and deficiency of currents in the nerve-fibres, inasmuch as stimulation relieved the pain. She was so weak, that for days she could hardly walk across the room. The nervousness was extreme. Yet Dr. Brunton recommends spirits for indigestible foods, as lobster,\* because he says the lobster fibres remain so long undissolved in the stomach. Can he guarantee that the momentarily increased flow of gastric juice, followed by a cessation of the same, shall be powerful enough to accomplish in a brief period the work of digestion, which nature takes hours to accomplish. The theory does not seem philosophical, and moreover multitudes of cases similar to the above not only prove that alcohol does not digest these indigestible viands, but also demonstrate how effectually it succeeds in leaving the stomach more powerless and helpless than before.

No. 3. A woman, aged 56, had been an habitual drinker, at times getting fresh, at others drunk. She took beer, which caused indigestion and windy spasms; to relieve which she took gin. The result was a chronic dyspepsia. On the Sunday before I saw her she drank beer with her dinner and supper, eating freely of parsnips, plum-pudding, etc. On Monday she took roast pork, fried greens, and beer.

\* See *Practitioner*, Feb., 1876.

She complained of headache and lassitude. She vomited a quantity of Monday's dinner, and afterwards of Sunday's; the parsnip and plum-pudding were as undigested as when she swallowed them, and plainly showed that they had come from the bowel. She lost power in her arms and hands, and also in her legs, and while complaining of the numbness and pricking she fell heavily on the floor and died in a few minutes. This is surely a case in point for those who plead that alcohol assists digestion; yet, although this woman took regular doses of the medicine, her Sunday's dinner was apparently quite unacted upon 36 hours afterwards. If she had got drunk there might have been an excuse, but she simply took the liquor (porter or black beer) with her meals, in what is called moderation; and the result was nerve exhaustion and death. There was no vitality available to the stomach for 36 hours. The alcohol did seem to give an appetite and to help her to fill her weak stomach on the Monday, but languor and lassitude overtook her to such a degree as to vex and astonish her. She seemed unable to rouse herself to get the tea. Tingling of the limbs, numbness and paralysis, the three warning stages of exhausted nervo-electricity set in—exhaustive drunkenness, vertigo, and death.

The action of spirits, ports, and sherries, on the alimentary canal is doubtless the first cause leading to dipsomania. In such patients the mucous membrane of the throat, œsophagus, and stomach becomes chronically congested. If you examine the throat of

such an one you will notice a dryness and a deep dusky purplish flush. The dryness causes, by reflex nerve action, a continued exudation of mucus, and the victim is for ever spitting. The nerve force being continuously drawn to the part by the chronic irritation causes a deficiency of nerve currents in other parts ; hence the trembling of the hands, the sense of oppression (lack of complementary nervo-electricity) in the brain hemispheres, and consequent nervousness, fear of impending danger, and tendency to suicide. In this sad condition, the weakened irritable stomach and exhausted brain act and react upon each other, keeping up and intensifying the mischief, the state of the stomach making the man a dipsomaniac, the state of the brain making him desperate, and careless of life, and dangerous to himself and others.

No. 4. I attended a patient in this condition. I forbade all stimulants, and endeavoured to relieve the congestion of the alimentary canal. By careful watching I often mitigated or warded off fresh and more severe attacks, but at last he was taken out of my hands by a consultant physician, who would see him gratis, barring a handsome present now and again. This gentleman increased the mischief, by at first ordering him to take one tablespoonful of brandy, one tablespoonful of arrowroot, and a teaspoonful of water twice or thrice daily. The effect of such a dose, the pain and discomfort is more easily imagined than described—the patient thought it to be like hell-fire. After a time he altered his treatment, and ordered a tablespoonful of brandy for breakfast,

and again at 11 a.m.; two glasses of ale for dinner, two for supper, and two glasses of whisky and water after supper. I need not say that the patient did not stop at the second glass of whisky. I made it my business to call and see the physician, placing my late patient's health beyond any personal feeling. I expostulated with him, but he pleaded that by allowing so much the man would drink no more, and so could be gradually reduced. Alas, in three weeks the patient was a confirmed maniac.

I have met with cases in which ardent spirits have caused a hardening of the coats of the stomach and a tendency to schirrus, with all its horrible symptoms. In other cases a sponginess of the mucous coat has been induced; the least irritation from indigestion, or even from mental causes, giving rise to vomiting of clots of blood, phlegm, &c.

There is a milder form of the disease, which has not hitherto been recognised, but which is nothing more nor less than a form of dipsomania. The patient tells you, and honestly, that he cannot do without it. Such a sinking at the pit of the stomach; such a weariness and lack of energy for either mental or physical labour; such a thirst; until he is obliged to take the glass to get temporary ease and quiet. This class of patients are not counted as dipsomaniacs, because they do not get drunk, because they have not yet descended to the base of the incline, because they still hold their own in society.

But the symptoms are the same in both classes of patients; those I have described, and those who

are generally classed as confirmed dipsomaniacs. The difference only is in degree, and this is very largely dependent on the amount of native strength. The patient, of a weakly constitution and very excitable, sensitive disposition, may be made a confirmed dipsomaniac by the same amount of indulgence only, which has led the strong man to shew no other sign to the outward world, than the one in which he boasts, and of which he does not know the "danger, "I cannot do without it." A short time ago I visited a friend, a religious man, and holding a high position in the Church, who uttered this cry, "I cannot do without it." A medical man had ordered him, as imperative, to drink as much brandy as his head would allow; to take three or four glasses of sherry daily, and, if he could afford it, an equal amount of champagne. He followed the directions, believing he was doing a christian duty to his own body. His stomach became so irritable and weak that, to drink a glass of cold water would make him ill for hours. His gait was most nervous and irritable, and, by the doctor's orders, the man had got dipsomania. Surely this was the blind leading the blind! Such a state is disease, and all people who drink, and who cannot, of their own free will, take it or do without it, but who must have it, are nothing more nor less than dipsomaniacs, and ought to go to a conscientious, skilled medical man for medicine and advice.

Thus, judged by daily experience, by Dr. Beaumont's observations, and from the examples here noted, it would appear that alcohol stimulates the

stomach, and promotes a flow of gastric juice for some short time, provided that the person be not habituated to the stimulant, and provided that exhaustion and disease have not greatly devitalised the viscera, provided also that the gastric glands have previously secreted a healthy juice, and will answer to the stimulus. But immediately after the alcohol is absorbed into the general circulation, the stimulus is gradually withdrawn by the alcohol, and directed to other parts, the stomach is left with a quantity of viands to digest, and with less power, until the alcohol is eliminated from the system by combustion. Thus alcohol may fill the stomach, but it certainly appears to delay and retard digestion, and this, in an exhausted and weakly constitution, is both foolish and dangerous.

#### V. The reflex and direct action on the general circulation.

Immediately the alcohol is taken, its effects on the alimentary nerve-fibres are so severe that, by reflex action the stimulus is passed from nerve-centre to centre, and almost instantaneously the circulation is increased, both in rapidity and in volume. The heart's action is intensified, and the arteries dilate ; there is a momentary stagnation, causing redness and swelling, until the capillaries are distended, and until the veins accommodate themselves to the increased volume of blood to be poured into them. All this simply results from stimulation, at first and for a brief period reflex, but afterwards reflex and direct, of the cerebro-spinal nerves. Dr. Richardson, Dr. Edmunds,

and the writer of a leading article in the *Brit. Med. Journal*, tell us that this flushing is due to paralysis of the vaso-motor nerves. I fail to see any reason or proof for such assertion. Paralysis of nerves, although I admit the term is used most vaguely, appears to be a serious matter, and not a mere condition which can be easily produced one minute, and rectified the next. No active nerve-currents pass to the muscles when at rest, and yet we do not say those muscles are paralysed. No active nerve-currents pass to the brain hemispheres in sleep, the exceptions are dreams, and yet we do not call the sleeper paralysed.

Paralysis, the loosening or abolition of function, signifies temporary death of the part, dependent upon injury to the nerve-centre supplying such part, or to the cutting off the communication from the nerve-centre, through injury or otherwise.

We sadly need a word to express that condition of the nerve-fibres, the passive state, when they are quiescent, simply because the nerve-currents are directed elsewhere. I would suggest the word kratolysis, the withdrawal of manifested force or strength.\* Alcohol not only flushes the skin, but it, for some short time, causes a redness of the surface, and the sensation of warmth, and slight increase of temperature. Thus,

\* The two conditions may be distinguished thus : in kratolysis, the application of a strong enough stimulant will incite a manifestation of nerve action ; in partial paralysis such application will only produce an imperfect manifestation, in complete paralysis the stimulation will produce no manifestation at all.

if this state be produced by paralysis of the vaso-motor centres, we should have a prolonged period of paralysis of the vaso-motor centres generally, a condition at once fatal to life, for the circulation would be so violent, that inflammation of the viscera would quickly end life.

Further, paralysis of the nerves through severe stimulation should be preceded by an exalted activity of the same nerves. Thus, before the flushing and heat, we ought to get depressed circulation, pallor, cold sweats, rigors, and even syncope, because, when the depressing and restraining power is stimulated away, paralysed, killed by the alcohol, the heat and flushing follow as the concomitants of unrestrained cerebro-spinal action. But no such depressor symptoms attend the first use of alcohol. If it did instantaneously, and without previous action, paralyse the vaso-motors, it would be the most dangerous drug we have, and certainly fatal even in small doses. There is not the slightest proof that the vaso-motors *are* paralysed. These nerves are the scapegoat of modern physiologists. Unexplainable mysteries are turned aside, difficulties are vanished by paralysing the vaso-motors. And yet no physiologist knows the fearful forces he is calling to his aid, whenever, at his command, the genii obey his dictates. Paralysis of the vaso-motors, that is, stimulation of these nerves, and consequent depressor symptoms, until all their life is stimulated away, all the depressor restrainer power destroyed; and, as the consequence, the cerebro-spinal or excitor nerves exerting unchecked their full

sway! Such a thing is almost an impossibility in warm-blooded animals of high organisation, because clots of blood form in the heart, and congestion takes place in the lungs from the direct depressor action of the sedative drug, which conditions render life untenable before the drug has exerted power enough to paralyse the vaso-motors. But if not noticeable in the higher animals, it may be seen at any time with insects. If a moth or butterfly be put into a jar containing weak fumes of prussic acid or chloroform, the muscles will be instantly relaxed, but in the course of two or three minutes, the vaso-motors will become exhausted by means of the sedative drug, and suddenly become paralysed. At the same second as vaso-motor paralysis occurs, the cerebro-spinal nerves will exercise unrestrained action, and all the muscles become rigid. The insect is apparently dead, and in the spasm of rigor mortis. If directly rigor mortis sets in, the insect be taken out of the jar, and exposed to a steady breeze, so as to blow away even the smell of poison from it, the vaso-motors will gradually recover, and as they do so, the insect will relax, and in a few minutes rise up and fly away. This is paralysis of the vaso-motor nerves, as argued and shown philosophically; but no such symptoms occur from moderate drinking, before the face becomes flushed. Poisoning by Curari presents a near approach. As a part of the vaso-motors are severely stimulated, the cerebro-spinal motor nerves are inert, the nervo-electricity being withdrawn from them and directed by the Curari stimulant to par-

ticular vaso-motor fibres. Kratolysis, inaction of the muscles is the result. Strong stimulation will make the muscles act, but left to themselves, they are as it were, asleep. In this stage, the formation of a clot in the heart generally causes death, but if life could be maintained until paralysis of the vaso-motors set in, the muscles, instead of being relaxed, would become rigid. As it is, this is clearly indicated—for nature, by the reflex action of the cerebro-spinal seeks to right herself, and the result is seen in convulsive spasms of the muscles. Dr. Taylor gives a case of chloroform-poisoning, in which the muscles to a degree became set, the jaws clenched, etc., and which recovered, but such cases are very rare, and he put some of the symptoms partly down to hysteria. In a man at one of our hospitals, to whom chloroform was being administered, no bad symptom was noticed until he suddenly became rigid. Doubtless this was a true case of vaso-motor paralysis. All means failed to restore him. What a terrible punishment then, is this vaso-motor paralysis, which Dr. Richardson claims as falling upon all drinkers!

Allow that alcohol is a direct stimulant, keeping up the circulation for a time, even as running or other violent exercise, and all difficulties appear to vanish. But it is impossible to say that it paralyses in the true sense of the term, without having to resort to all sorts of theories to explain the individual facts. As the alcohol stimulates particular portions of the nerve-tract, the circulation is gradually reduced, so that as Professor Parkes told us, the mean

ratio of the pulse, after taking spirit, is not increased in the twenty-four hours. It is urged that, as the blood is directed to the surface, the viscera are, to an extent, deprived of the same.

But where is the proof? Why does the gastric juice at first flow more freely, unless because an increase of blood goes to the stomach? Again, in poisoning by alcohol, primarily or more slowly, why are the viscera, especially the stomach, liver, and mesentery, so congested? There is no reason why we may not give it as a fact that alcohol exalts for a time the circulation generally—hence the pleasurable sensation of warmth, the disappearance for a time of languor and certain classes of pain, and the ease and carelessness drinkers so greatly covet and hanker after. But as before remarked, these sensations are all temporary.

Persons exposed to severe cold suffer more terribly after taking alcohol. Dr. Brunton describes the theory generally received in explanation, but I must again demur to both theory and conclusions. He says, "Cold shuts (congests) the vessels of the skin, and so heat is retained. But alcohol opens up vessels of skin, and so the radiation of heat is increased—the blood is colder—and each circulation goes colder to the heart and viscera, and hence congestion."

It appears that the doctor does not distinguish between two conditions—1st, a person at rest exposed to cold, and 2nd, a person in motion exposed to cold. In both cases the cold shuts the pores of the skin. In both cases the cold at first, by reflex

action, stimulates or braces, causing a flow of blood to the surface, reddening and flushing the parts exposed, and, consequently, an increased radiating heat. In the person at rest the vessels gradually become narrowed, blocked, congested, and if the weather be severe enough, frozen. The blood is driven inwards, and, according to Dr. Brunton, the heat retained, yet nevertheless how often sleep and coma follow! In the active person exposed to cold, the motor stimulus keeps propelling the blood towards the surface, and, consequently, there is a continually radiating heat. The pores of the skin are shut, the vessels of the surface are to a degree contracted, but the continued activity keeps forcing enough blood through them to maintain the glow on the surface. The perpetual vital stimulus does exactly the same thing as alcohol in driving the blood to the surface, yet sleep and coma do not set in, as long as the condition can be maintained. If Dr. Brunton's theory be correct, "that the surface cooling and the driving the chilled blood to the heart and viscera causes congestion and death," then we should expect to see the person at rest fare better than the person in motion, for in the former a natural girdle is, so to speak, spread over the body, and the heat is kept in, while in the latter the heat is continuously radiating, and the cooled blood being returned to the heart. The increased radiation and cooling of the blood is doubtless greatly exaggerated, for while this condition is present, there is by reflex nerve action increased energy and volume in the blood-

flow, and doubtless increased combustion and consequent heat.

Cold weather sharpens a man's appetite, especially for fat and starch foods. Why does the Greenlander eat his twenty or thirty pounds of blubber, excepting to supply a radiating heat? Further, if there be not a radiating heat, what is there to keep out the cold? As long as the fire is maintained in the greenhouse, the frost does not get at and destroy the plants, but allow the fire to wane or to go out, and the cold and frost have full sway—and so with the body, as long as the heat from within is sufficient to keep up the natural temperature, and as long as the vitality is equal to propelling it to the surface, the surrounding cold cannot harm.

Why, then, is it that persons after partaking of alcohol—which propels the blood to the surface, and while doing so keeps out the cold—if they sleep out in the cold, so often die? First, because of the lower temperature resulting from the alcoholic combustion reducing the body heat, in these most favouring circumstances,  $1^{\circ}$  to  $5^{\circ}$ ; 2nd, because of the more tardy circulation, in consequence of the exhaustion, which follows the exalted condition which alcohol first induces; 3rd, because in sleep the powers of vitality are lowered; and 4th, because the nervo-electricity is exhausted, wasted, spent by the alcohol, until the residue is specially stimulated to a portion only of the sensorium, so as to preserve life—the cerebral hemispheres and body generally being to a great extent only passively alive, are almost devitalised

from the absence of life-currents and by the extreme cold. Thus there is little radiating heat and electricity to resist the physical action of the external cold. The blood flows more tardily, the lungs act more feebly, and, consequently, the blood is soon insufficiently aerated, blocking, congestion, and general stagnation take place, and sooner or later sleep deepens into death.

I have noticed one fact in connection with the circulation which may be of service to all practitioners. If there be any irritation of the lung or any engorgement of the liver or other resistance in the circulation, the stimulating pressing action of alcohol causes an amount of engorgement in the lungs, and consequently the exudation of a quantity of frothy viscid phlegm, and even of blood. The following cases prove this most forcibly.

No. 4. To a rabbit weighing about  $1\frac{1}{2}$  lb. I gave Tr. of Wormwood, and in a very short time the crepititation in the lungs became quite loud. I gave 145 minims of the tincture within  $2\frac{1}{2}$  hours. It died immediately on taking the last dose of mXL. On holding it up by its hind legs, a quantity of pink (blood-stained) viscid phlegm and fluid ran out of the mouth.

No. 5. An elderly man was suffering from dropsy, consequent on a scirrhous state of the liver. By entire abstinence from stimulants, attention to the stomach and bowels, and the taking such nourishments as the stomach could digest, he suffered little inconvenience excepting languor and debility. One

day he unfortunately transgressed, taking some boiled pork for dinner. At 8 p.m., feeling uneasy from indigestion, he took a glass of hot spruce and water. In a very short time the crepitation in his chest, which had been a minimum and only perceptible before, very greatly increased. He could no longer lie down, but had to be propped up in a chair with pillows. He kept spitting a quantity of viscid frothy phlegm and blood. The pulse by 10 p.m. had run up to 120, and was wiry and jumping. The pork caused diarrhoea. In 12 hours the violent coughing and spitting ceased, but the lungs were full of phlegm. He rapidly sank, and went off at last as in a sleep.

No. 6. A young man was admitted into the — Hospital, suffering from pneumonia of the right lung. He had been a heavy drinker.

On admission he was ordered :

Ammon. Carb. . gr. v }  
Dec. Cinch. .  $\frac{3}{5}$  i } 4tis horis.

4 oz. of Brandy, 4 eggs, 2 pints of milk, and 2 pints of beef-tea daily.

On entering the hospital the left lung was quite normal. He died in fourteen days, when the left lung was found to be congested throughout.

This was trying stimulation with a vengeance—the poor man had only one lung to do the life-work, and yet the treatment consisted in impelling by all means at command, the blood in the pulmonary circulation, and so well succeeded as to block up the sound lung, and take away the only chance of curing the diseased one.

No. 7. A woman aged 50 was suffering from catarrh and slight bronchitis. Her medical attendant ordered her to take a quantity of brandy. It simply increased the exudation of phlegm and upset the stomach, keeping up by reflex action of the debilitated stomach on the throat a troublesome tickling cough. After suffering thus for three months, and her medical man could do no more, I was called in to see her and take the case. I found her bedridden, propped up by pillows, unable to lie down. I ordered boiled milk in place of the brandy, and gave simple remedies for the bronchitis and dyspepsia. In three days she was able to sit up, and in a week was able to lie down in bed.

#### BRONCHITIS AND WHISKY.

No. 8. A strong, hale man was seized with bronchitis. He was treated with spirits, etc., to keep up the strength and to help nature to throw off the disease. When I saw him, he was bedridden, and the disease was of three years' standing. He could not raise his arms above his head. If lifted out of bed, he would almost or quite faint. His heart was so weak, that the least excitement would cause severe palpitation and nervous exhaustion. The pain at the pit of the stomach, the sensation of sinking which asks for a pick-me-up, was unbearable, and by the doctor's orders was relieved for a few minutes by alcohol: the stomach was so irritable that it continually ejected the food. The oppression on the brain, or defective flow of nerve electricity to the hemispheres

was so terrible, that he simply groaned when left alone and cried aloud in agony. Life was a burden almost unbearable, and was below even natural vitality; yet he was being hurled onward by half a bottle to a bottle of whisky a day in addition to porter, port wine, etc., whichever he fancied, by an amiable consulting physician. Thus the disease was increased and confirmed; the stomach ruined and the heart shaken almost to pieces; the strong man brought to the verge of the grave and to the approaches of insanity by means of alcohol. All these cases appear to prove unmistakably the evil of stimulating the already congested or blocked circulation. The stimulant simply keeps up and intensifies the disease and exhausts the whole nervous system.

VI. The direct action of alcohol on the sensorium or nerve tract. Alcohol is a stimulant in all its doses. How does the drunkard's trembling hand become steady under fresh doses unless nerved, fortified by the stimulating draught? No one, I believe, will urge the power as the result of vaso-motor paralysis. Why does it excite into action the hemispheres of the brain and give subtlety to the intellect? Certainly not as some have maintained by paralysing the restraining powers of the soul. Why does the ship move hither and thither at the mercy of the storm? not because the rudder has lost its power, but rather because the storm is more powerful than the rudder. Why does the strong pugilist overcome the weaker one? not because the latter has no power, but rather because the strong

man overpowers his strength. And so while the vessel slowly obeys the rudder in calm weather, it no longer heeds when it becomes a plaything to the angry winds and waves. And the brain hemispheres and other portions ordinarily under the power of the will become simply furious, as they passively and helplessly sway hither and thither impelled by the restless God, Bacchus. The vessel and the brain thus agitated by the fury of the elements exhibit no co-ordinating power, no oneness of direction, but impelled by this current or that current sway to the right or the left, backward or forward, or at the bidding of the many clashing currents rise mountains high, where brutal murders and most heinous crimes blacken the waves, or sink into the valleys and whirlpools of the flood where the suicide so often sinks in the jaws of death. What a fool is man purposely to subject his bark to such a tempest ! Say that alcohol cannot be a stimulant, because it is a narcotic — why does it propel the blood to the surface, and *drive* it with such force to any wound or sore, as to make the healthy healing wound angry, the healing ulcer bleed, and even tear asunder the edges of wounds which have more or less united ? Alcohol not a stimulant — why is it that the passions are so aroused under its power, that thousands of married men, most faithful to the home and wife, at the sight of the fallen, ignorant of the evil, follow heedlessly and irresistibly the sensual dictates ! Does increased flow of gastric juice prove paralysis ? Does the relief from sensation and

weariness prove paralysis ? If so, the sooner mortals are paralysed the better. But all the phenomena undoubtedly prove that alcohol is a most potent stimulant. But the question may be asked, seeing that it is such a stimulant to the flagging powers of life, should it not in proper doses give life and health and all things. And undoubtedly it would, if its action on the stomach were not so deleterious and if it contained or could appropriate the materials necessary for building and resuscitating as well as those which stimulate the fountains of life. But it is so potent, it rapidly exhausts. The people do not care for, and medical men do not prescribe doses, which would not in any degree exhaust, they must see tangible effects or they believe the dose inert ; hence as alcohol is at present used, exhaustion, I do not mean stupor and drunkenness, but a large draw on the capital or reserve nerve-force, a strain upon the nerve-centres, invariably results.

As noted before, the nervo-electricity is generated and is available so much per minute. If an overplus be stimulated to one point, it must be withdrawn from others. The example of Weston, the walker, conclusively proves this. By the power of the Will, he stimulated a large amount of nervo-electricity to the legs. The result was his stomach had no power for digestion, and the brain hemispheres little for thought. If he ate anything stronger than very weak beef tea, or if anxiety set him thinking, the effect was quickly seen in his diminished speed. While alcohol stimulates the whole sensorium, it

specially stimulates certain tracts, and most of all the medulla oblongata. Seeing that nervo-electricity is generated so much per minute and that alcohol uses it up more rapidly than it is generated, and since it specially stimulates certain portions of the brain and medulla, the nervo-electricity is withdrawn from centre after centre, leaving the parts which such centres supply, passive, dormant, but not in the true sense of the term paralysed. Thus the legs, arms, cerebral hemispheres become dormant, but may be again wakened up, provided there be enough nervo-electricity left, and provided a greater stimulus be applied to them, *i.e.* a stimulus which will again draw to them the nervo-electricity from the parts to which it is stimulated by the alcohol. The following experiment illustrates this.

*Ex. 10.* To a rabbit weighing 1 lb.  $7\frac{1}{2}$  oz. I gave ; at 7.5. Ten drops of rectified spirits of wine in three drachms of strong tea.

7.20. Only slightly stupid. Eight drops of spirits of wine in five drachms of tea.

7.21. Very lively—is seized with a sudden trembling hind legs give way.

7.30. Galvanism at first exerts little power, but repeated currents restore and make it lively.

7.40. Eight drops of. rectified spirits of wine in half an ounce of tea. It instantly drops on its side quite powerless: pupils slightly sensitive—appears as if dying—slight but well manifested convulsions. Battery scarcely influences it, until put on at full power, when the

currents exert more palpable effect each time. After a period of rest, a strong current causes very severe and rapid action of the whole frame: this shock leaves it exhausted and cannot be repeated for several seconds.

7.45. After gentle currents stands on legs—trembles, very violent palpitation.

7.50. Quite recovered consciousness. Is more quiet.

The rabbit was drunk at 7.40, sober at 7.50. By adding other stimulants to the alcoholic potion, the nervo-electricity is divided, and the alcohol consequently exerts less power than when alone. In this case there were three stimulants, alcohol, tea, and electricity.

Again, after taking alcohol, the nervo-electricity is withdrawn from the cerebellum early or later according to the circumstances. When the man is sitting down, there is little necessity for co-ordination of muscular movements, and hence less of power in the cerebellum is not easily perceived in that usual posture of drinking. But in all cases the cerebellum becomes inert and unable to co-ordinate muscular movements before the cerebral hemispheres lose consciousness. The drinker sees double, and walks unequally before he ceases to think and know.

Again, the man may be tolerably sensible by the efforts of the will, the body being at rest, directing the available currents to the hemispheres, but directly he gets up and goes out into the fresh air, the general stimulus of the fresh air to the surface of the whole body and to the lungs, the direction of

the co-ordinating power by the power of the will to the legs, leaves the hemispheres and the fibres of the cerebellum co-ordinating them, minus power, and the man falls down insensible. The hemispheres fall to sleep. The parts supplied directly from the medulla are the last to lose vital power. This is doubtless why the anus so long remains sensitive and why alcohol stimulates the passions to such a degree. The heart is stimulated longer than the respiratory functions, and often beats twenty minutes to half-an-hour after the animal is apparently dead.

Large doses of alcohol will often cause sudden death. Sir Benjamin Brodie urged that they do so by reflex action on the heart and vessels. Dr. Brunton compares this effect to the blow on the epigastrium, which knocks out a man's wind, or, if severe enough, kills. Both cases are analogous, and mean the withdrawal by reflex action of nervo-electricity from the vital nerve-centres. Knock out a man's wind—in other words, withdraw the nervo-electricity—and the phrenic is for some moments, until recharged with nervo-electricity, powerless to act upon the diaphragm. Let the blow be still more severe, so as to abstract the nervo-electricity from the centres supplying the lungs and heart, and death will most probably result, inasmuch as congestion will set in before those centres have time to recover, or because the cessation of the blood-flow means the cessation of the generation of nervo-electricity and life. And so a very large dose of alcohol taken at a draught abstracts the nervo-electricity even from the

medulla or vital centres. This is proved, because if the stimulus be gradually applied, spread over a longer period, so as only to abstract the nervo-electricity from the spinal cord and brain hemispheres, drunkenness and coma simply result and pass off, all circumstances being favourable, with the combustion of the alcohol. But if the same dose be taken at a draught, the drinker will probably fall down dead. The habitual use of alcohol will often lead to paralysis or partial paralysis of various nerves, notably of the hand and arm. The following are cases in point:

No. 11. A man aged forty had been a great drinker and free liver. His occupation was a clerk. His habits of life had so debilitated him, that in holding his pen the thumb would lose all power. He could bring down an amount of nervo-electricity or vital power by friction—by cold water, &c. But this was not constant, and the matter became so serious as to threaten him the loss of his employment. The man had so drawn upon his capital, exhausted his nerve-centres, that there was not enough to return the interest, generate the nervo-electricity or strength, necessary for the proper performance of the functions of life, hence the part became permanently weak.

No. 12. A similar case to the above. A married woman about thirty-seven years of age took to drink, chiefly ale, but sometimes spirits. The right hand became somewhat swollen and two fingers (the median) completely paralysed—the ring and little finger (ulnar) partially so. She could not catch

hold of anything, or if she mechanically got anything on her hand, she let it fall. On leaving off the alcohol, and taking iron and strychnine, she slowly regained the lost power.

The following case notably illustrates the power of alcohol as a stimulant to produce inflammation, and to tear open healing wounds.

No. 13. A woman fell on the step of an omnibus, and cut her hand open for nearly two inches in the palm and ball of the thumb.

I kept it bound, and applied a weak carbolic lotion. The gentle stimulus acted so well that it was nearly healed in two days—for one inch it was quite healed. At this juncture, with some company, she drank very freely of whisky, etc. This drove the blood with such vehemence to the part that even the alcoholic intoxication or stupor failed to lull the distracting pain which during the night nearly drove the woman out of her mind. On seeing it next morning I found the parts red, swollen, and inflamed, and so angry that the wound gaped nearly to the same extent as when I first saw it. On leaving off stimulants, the hand slowly healed—on taking them, it was as often put back. The cure was unsatisfactory and considerably delayed by the woman's foolish conduct.

The above case also illustrates the distribution of the nerve currents. The woman took enough alcohol to make her drunk, but the severe pain of the hand wakened her up, so that the alcohol exerted less intoxicating power, than it would have done if she had been quite well.

No. 14. Although 25 drops of spirits of wine killed a rabbit, weighing about  $1\frac{1}{2}$  lbs., yet 193 drops, given within the hour, did not kill a confrère, because modified by  $\frac{1}{26}$ th grain of strychnine. The  $\frac{1}{60}$ th of a grain of strychnine would have been a fatal dose if the stimulus had not been divided ; the large amount of alcohol and strychnine in the body, and the length of time required for the combustion of the spirit and elimination of the strychnine, induced chronic disease ; the rabbit died in six weeks after the experiment, the liver being severely congested, nearly black, and easily breaking down on pressure.

#### TINCTURE OF NUX VOMICA.

No. 15. To a full-grown cat of moderate strength I gave :

9.14 a.m. Tincture nux vomica, 3 drachms, water, 3 drachms or  $\frac{1}{2}$ th gr. strychnine and 3 drachms of spirits of wine.

9.28. Drops off to sleep, but instantly starts up in a fright. When it sleeps the nodding its head wakes it in a fright.

9.32. Has a slight convulsion in which neck is outstretched and stiff.

9.35. Wakes suddenly and gives a convulsive start, which shakes its whole frame. It tries to walk, but the hind legs give way, and it can only drag itself along.

9.38. Stroking the fur over the head and back caused it to give a convulsive start, which conveyed a severe electric shock to my arm. This was re-

peated several times, the electric twitches followed as rapidly as the strokes, until the hind-legs entirely gave way, and the cat rolled on its side posteriorly, the fore-part still on its belly. As often as put on all fours it rolled over as before.

9.41. A true spinal convulsion, in which the back was bowed for thirty seconds, now occurred for the first time.

9.48. A severe spinal convulsion. Exhausted, it sleeps, but the least movement of its head, the least noise or even touch awakes it, and induces convulsive spasms of the muscles. When awake, its eyes are sensitive, the hind-legs powerless, its fore-legs too weak to support it. In the convulsive spasms, it rapidly extends its hind-legs backwards and forwards.

10.3. A severe convulsion, extends itself and breathes as if blowing a bellows for some thirty seconds.

10.3 to 10.18. Convulsions and spasms occur.

10.18. Touched it on the head, when it deliberately raised its head, and looked round to see. Sneezes.

10.22. On irritating it over the medulla, a severe convulsion was induced, in which the back was bowed for a minute; the legs pointed backwards, the fore ones vibrating rapidly, the hind ones powerless and quiet, excepting as they were shaken by the general spasmodic action which seized the whole frame. Breathing as it came to itself a blowing sound, Res. 128. Endeavours to incite another convulsion only produced abortive spasms, until—

10.44. A convulsion, but less severe and shorter than at 10.22. Does not blow afterwards; snaps its teeth feebly.

10.46. Dead.

Pupils sensitive up to 10.44.

Post-mortem Lungs marked with incipient patches of inflammation. Colon and mesocolon congested in patches. Small intestine not affected. Membranes of the brain severely congested.

In the above case neither the alcohol nor the strychnine exerted their full power. The alcohol at first was in the ascendancy, and it was not until the lapse of half-an-hour that the strychnine induced a violent convulsion. The convulsion at 10.22 so severely exhausted it, that fully twenty-two minutes elapsed before another and less violent one could be induced. This so thoroughly exhausted the remaining vitality that before the nerve-centres could be recharged, congestion and insuperable obstruction in the circulation stamped the death-warrant.

Various drugs given together with alcohol, will exhaust the whole nerve economy, and if they act severely on the stomach often induce convulsions.

#### GENTIAN AND SPIRITS OF WINE.

No. 16. To a white cat, two-thirds grown, I gave :

7.44. p.m. Extract of gentian . . 2 drachms.

Rectified spirits of wine 6 , ,

Water . . . . 1 ounce.

7.45. Involuntary watery evacuation.

7.46. Hind legs are giving way.

7.51. Falls on its side ; the fore-legs fail to support it ; is stupid and vacant, but not insensible.

7.56. Almost insensible. Res. 32 deep.

8.2. Attempts to rise, but fails : the small power in its fore-legs, and absence of all power in its hind-legs, cause it, when attempting to rise, to keep turning round.

8.7. Held up by the ear ; it was quite unconscious.

8.10. In turning round as described above, it got its fore-legs over the table edge, but was powerless to advance or retract.

8.15. No movements of the limbs, perfectly quiet.

8.18. Sudden convulsive spasms ; it moves all its legs as if walking, and in regular order, 36 times (72 paces) in the minute ; seeks to rid itself of the viscid saliva hanging from its mouth, but is perfectly unconscious.

8.23. Hind-legs ceased ; front-legs moving slowly and quietly.

8.23 $\frac{1}{2}$ . Its legs again suddenly begin to move, the hind ones slowly, the front ones violently.

8.32. On pressing the kidney between the fingers, the nerve currents are drawn down, and the head and neck violently shaken.

8.55. Convulsions ceased.

The animal lay quiet, breathing feebly, and died about 3.0 a.m., between seven and eight hours after the experiment.

Here three quarters of an ounce of spirits of wine killed a cat two thirds grown, the gentian in combination causing convulsions.

## OIL OF CAJEPUT AND SPIRITS OF WINE.

No. 17. To a healthy full-grown cat I gave :

Oil of cajeput . . . . 3 drachms.

Rectified spirits of wine . 5 , ,

Water, a sufficiency.

It rapidly lost power of limbs, but the chief characteristic noticeable was its fierceness. It continually snapped as though trying to bite some imaginary object. The respirations were very deep, the whole body moving in waves passing over the thorax and continuous through the abdominal muscles. It died in three quarters of an hour. Though very restive and fierce, there were no convulsions.

In the *post-mortem* the left and anterior sides of the stomach were found to be dark and congested. The lungs were very severely congested in patches. The liver and kidneys were also severely congested. The fluid in the stomach gave no indication in the flame of spirits of wine, but both stomach and lungs smelt very strongly of oil of cajeput.

No. 18. To a kitten about one third grown I gave :

10.55. Steel wine, three and a half drachms.

10.57. Respirations 30, deep.

11. Steel wine, two and a half drachms.

11.1. Quite powerless.

11.4. Quite insensible.

11.8. Apparently dead, but on opening the thorax and wounding the lung by accident, white froth

and red blood flowed in response to vibrations of the heart.

11.26. Intercostals ceased. Serratus magnus decreasing.

11.35. All motion ceased.

*Post-mortem.*—There were several worms in the stomach, three inches long, but quite dead.

In this case there were no symptoms beyond the ordinary alcoholic poisoning. No convulsions. The alcohol was effectual in killing the parasite worms. The quantity given would be equal to nearly a quarter of an ounce of rectified spirits—the amount of iron would be comparatively small.

#### CAMPHOR AND SPIRITS OF WINE.

No. 19. To a full-grown cat I gave:

4.30. p.m.  $2\frac{1}{2}$  drachms of rectified spirits of wine.

Camphor as much as it would dissolve.

4.31. The animal is very excited, most active, and jumps about spasmodically.

4.32. Drops down dead.

In the *post-mortem* made  $4\frac{1}{2}$  hours after death, the lungs were found severely congested. Mesentery and lining of bowel congested, very severely in small bowel, very slightly in large. Camphor is a general stimulant; 120 grains would be only slightly modified by  $2\frac{1}{2}$  drachms of spirits of wine. Dissolved in the spirits, and injected direct into the stomach through a tube, it would rapidly be absorbed with the alcohol into the circulation. It acted

direct, immediately stimulating the lung and small bowel. At the same time it acted as a general stimulant, exciting the animal until it dropped down dead. Oxygen acts in a similar manner, but not so severely or rapidly. The power camphor has to stimulate the system generally, to stimulate the small bowel, and to stimulate the lung, explains why it is useful in the first stage of a cold, why useful in atonic diarrhoea of the small bowel, specially cholera, and why it is given for coughs in the compound tincture of camphor. Thus we see, it is only by direct experiments on animals that we can form a judgment as to the action of medicines on the animal economy.

No. 20. Experiments with Calumba and spirits of wine produced no convulsions. Worniwood and spirits of wine produced no convulsions, although the injection of absinthe by M. Magnan, at Norwich, caused epileptic convulsions in the dog, perhaps because of the adulteration with fusil oil and other drugs, or because of the severe shock and exhaustion to the system.

### VII.—*The claims of Alcohol as a Food.*

The answer to this must be decided by the range included in the term food. No one claims alcohol as an azotized food or flesh-former, inasmuch as it contains no nitrogen. Some do claim it as a food, because it will give heat. Dr. Anstie got over the difficulty by making everything food. The air we breathe is food ; the water we drink is food. Air and

water supply the physical conditions for the adaptation and assimilation of the foods to the tissues of the body, but in the popular and strict sense can hardly be accepted as foods. "The medicines we prescribe are food ; the food we eat is food. In fact, to carry out the argument, we are dust and ashes, therefore dust and ashes should rank as food." But to look at the matter in a common-sense light, a food is a substance which can be easily digested and easily assimilated to the fluids or the tissues of the body. Now alcohol cannot be dissolved by the gastric or other juices, neither can it be converted into glycogen. A food is a substance which may be taken habitually with benefit to the body, and which shall not severely irritate or exhaust any portion of the body, and which shall not, excepting by mechanical irritation, cause congestion and inflammation of the parts with which it comes into contact. Viewed in this light alcohol cannot be a food.

Sulphuric acid taken internally will abstract the water from the tissues, and in doing so liberate heat. Many drugs taken into the body undergo chemical change, and in doing so liberate heat. But these heat givers are not foods. Alcohol gives heat, but it is insufficient to maintain the body temperature. Alcohol gives heat, but at the same time destroys the lamps.

Dr. Brunton urges that alcohol is food, because life can be maintained by its aid for some time. But who covets such life. No energy, no vigour, utter debility, no aspirations beyond the sparkling cup, no vital energy to resist the ills of life. Alcohol give

life? No! the utmost it can lay claim to is a slight prolongation of the time during which the smoking, waning embers are dying out. A hibernating animal will live for months and resist the cold by means of the fat stored up in its body. The fact is, in such circumstances there is little call for energy and waste in the shape of active vitality, and hence little food is required. And in the utterly debilitated drinker, or other, there is no call for food because there is no energy to be elaborated. Looked at in an unbiassed and common-sense way, I cannot see how alcohol can be considered a food.

#### 8.—*Alcohol as a Medicinal Agent.*

Alcohol is too general a stimulant to be of much service in local diseases. It stimulates the stomach and liver for a short time, and then simply leaves them more powerless than before. When an organ is severely stimulated by a drug it becomes inactive for hours. Dr. Rutherford's experiments illustrate this. The liver of the dog stimulated by a large dose of rhubarb poured out a large quantity of bile, but was quiet for hours after. A drastic purge is often followed by constipation, exalted stimulation by sleep. Alcohol in this way stimulates the uterus, and if powerful enough may at once expel the foetus, but if not powerful enough the uterus gradually loses power, because of the alcohol directing the currents elsewhere, and the patient is exhausted; the pains are cramping and useless, and a period of rest is necessary before the accouchement can again advance.

A medical man, or a nurse, cannot succeed better in ensuring protracted labour than by giving alcoholic stimulants.

We have seen that indigestion is aggravated rather than otherwise by alcohol. It is urged, that in fever it lessens waste by lowering the temperature; and that we will not deny: but it lessens waste not because of any chemical action, but rather because of the physical condition it induces by lowering the temperature and by the exhaustion which it brings about. There is less waste when the body temperature is 99° or 100° than when it is up to 103° or 104°. Under the higher temperature the tissues are more flabby and relaxed, the generated vitality is lowered, and the exhaustion and degeneration proportionately greater. It is right to reduce the temperature. An ice-cap will rapidly do this, and at the same time gently invigorate the brain itself, often so much so as to induce sleep. Now alcohol does so by substituting a more feeble combustion, and only when it is strong enough to overcome and modify the depressor and reflex stimulant actions induced by the disease; but it at the same time exhausts. It may slightly interfere with the oxidation of tissues by appropriating the oxygen to itself, but chiefly by exhausting and lowering vitality. It prevents, or delays the elimination of the fever virus, or other offending wastes. It lowers the temperature; it lessens waste; but, alas! it wastes life. If the fever virus be very potent, very large doses of alcohol exert no apparent effect; when they do gain the ascendancy the exhaustion is very great.

Such practice is simply butting one poison against another and giving the patient double chances of death.

No. 21. I had a patient, a young lady, suffering from a very low form of typhoid—utter debility, and just the case, if any, for alcohol. I gave ten drop doses of rectified spirits of wine. I was obliged to desist after the second bottle, as the patient simply got weaker, each dose decidedly increasing the mischief; her sight, smell, taste, and hearing were all failing fast, and a troublesome chest cough (hypostatic congestion) came on. Only ten-drop doses in an ounce of water, and note the exhaustion it induced in the exhausted anaemic, almost lifeless patient! On leaving off the alcohol and giving weak local tonics the special senses quickly regained power.

Dr. Garrod saw the above case with me. It was certainly not a true case of active typhoid fever, but reminded one of the state of the Welsh fasting girl, or of a person in a trance. All vitality seemed gone, excepting just enough to keep up a most feeble circulation. The lung and bowel symptoms were simply the result of this extreme debility and sluggishness of the circulation. They all disappeared as soon as I succeeded in getting the stomach to assimilate milk and beef tea. Convalescence was very rapid, the patient's appetite appearing as though it would never be appeased.

No. 22. A lady about 34 years of age was travelling on the Continent with her husband. She had had several children, and was now *enceinte*. The rate and fatigue of travelling was too much for her.

She would keep up with the party, and to do so was continuously stimulated with wines and spirits. On reaching home she was delivered of a dwarfed puny child, which did not live. A low type puerperal fever followed. She was kept for weeks in a dark room. No one was allowed to see her. The medical attendant ordered her several glasses of port-wine daily. Each glass made her drunk. She lingered for weeks, only getting better as nature got used to the wine. In her convalescence she was troubled with a number of large boils or abscesses. She had every attention and comfort, yet was months in gaining even a moderate degree of life and health. If alcohol be such a life-giver, why was it so long in curing this lady? Does not the case powerfully illustrate the conservative action of nature and the wonderful tenacity of life. When the alcohol had to a degree lost its effect, then nature resuscitated her flagging powers by making use of such foods as were supplied to her.

At first sight any one could judge that the treatment was inconsistent. The doctor would not allow the least excitement, not even the stimulating influence of light, but on the other hand, as rapidly as the enfeebled nerve-centres generated nervo-electricity, it was exhausted and driven off by alcohol. Nature eventually overcame all obstacles; but why did the medical man so unskilfully prolong the struggle?

## BRANDY AND CUSTARD FOR COLLAPSE.

No. 23. *Med. Journal*, Oct. 16, 1875, Dr. Francis Wade gives a case:

"An elderly gentleman had an attack of influenza: when recovering, but enfeebled, he one night had symptoms of collapse, for which stimulants were administered. Their use was continued. He regained no strength, lost his appetite, had constant pain at the epigastrium, with nausea and occasional vomiting, and a hard, dry, brown tongue. His only nutriment was a sort of custard containing brandy, which he took frequently, in doses of one or two tea-spoonfuls. Even this aggravated the gastric disturbance. As he was not only very feeble, but becoming daily more so, his condition was alarming. The gastric disturbance was so marked, and the only food he took was so offensive to the stomach, that it occurred to me that the brandy it contained might be the cause of his symptoms. I resolved to make an experiment, and to stay for some hours to watch the result. Some custard was made without any brandy. Of the first teaspoonful he said that it was the only food he had taken for days that had not caused pain and a desire to eject it. In a few hours his tongue was moist, and he made a good recovery, with but one relapse caused by a dose of brandy."

The doctor further says: "Dryness and brownness of the tongue, dependent upon the state of the system at large, are indications for the use of stimulants, but

when dependent upon the condition of the stomach only are contra-indications." How bold the doctor to leave off the brandy, and to watch hour after hour for expected death! but contrary to his expectations, when the brandy retired *life* took its place. He tries to draw an ingenious distinction in the state of the tongue, but unfortunately the tongue always indicates the state of the stomach.

No. 24. I was called to see a young married woman living in the country, and suffering from rheumatic arthritis of the right hip. She had just discontinued the services of a gentleman who was giving her large doses of liq. ferri perch. The result was severe pain in the hip; the thigh was flexed and the knee drawn up. The tongue was dry, brown, and caked; the appetite was nil; the bowels were costive, and no sleep was obtainable excepting by hypnotics. She could not bear to be moved or touched. Her screams were piteous. I changed the treatment, straightened the limb, and kept it extended by a weight; relieved the bowels, toned the stomach, and stopped all alcohol; the tongue cleaned, she slept naturally, the appetite returned, and the hip rapidly improved. Being poor and unable to pay for attendance, I procured her admission to one of our hospitals. On the 9th or 10th day after I first saw her she was so far recovered as to be able to bear the journey—seven miles. She suffered no discomfort in the transit. On being put to bed hot fomentations were applied, which so comforted her that she declared she felt quite well. Unfortunately the autho-

rities could not leave well alone, but ordered her, after the fashion, two ounces of brandy daily. On taking it she became hot, flushed, and choked, and felt as if she would be suffocated. The pain in the hip again came on to such a degree as to necessitate a strong sleeping-draught—25 grs. of chloral hydrate—to give a temporary repose. This continued until the brandy did not inconvenience, that is, did not heat and flush, a period of nearly five weeks, when she began slowly to mend. Before she left home she was able to do without the suspended weights, but at the hospital, after taking the brandy, she was obliged to have them renewed to make the pain at all bearable.

This case, and No. 22, prove that the body may become habituated to the use of alcohol and to other drugs, as well as to altered physical conditions. The drug exerts less power on the nerves after they become accustomed to it. A man may remove from a temperate to a tropical climate, and may become acclimatised. If of a splendid constitution and physique to begin with, he may live to old age; but the greater probability is that he will die sooner than if he had remained in the old country. And so a person may become habituated to moderate drinking and feel little the worse, especially if there be plenty of active outdoor exercise, all other circumstances being favourable. But the greater probability is, that such habitual drinking will shorten life, especially if the person lead a sedentary city life. The daily difference is not appreciable, but it is patent at last in dyspeptic symptoms, lack of vitality, loss of

energy, excitable nervousness, and often increased corpulency of the individual.

And when a man does get used to it, it is quite a mistake to believe that it strengthens him, for there is nothing at all strengthening in alcohol, and if it have lost its stimulating effect, or if it be made artificially necessary (use is second habit) to raise the system as a lever, before Nature can do her work, where can be the advantage in making man live in an unnatural atmosphere? It must be infinitely better to cure disease and enable man to do his work naturally by means of the strength God gives him.

#### RECTIFIED SPIRITS OF WINE.

No. 25. I was called to see a woman about forty years of age, who had been suffering from menorrhagia more or less for a month. Great anxiety, poverty, and over-work had *completely* exhausted her.

The ordinary medicines seemed but to aggravate the symptoms. To the third bottle I added ten-drop doses of spirits of wine. Her general health improved. I repeated it in the fourth bottle, and the disease was cured. While taking this bottle she suffered from congested headache. I therefore gave no more alcohol, but attended to stomach, liver and bowels. The woman rapidly regained strength.

No doubt this case is explained by the alcohol propelling nervo-electricity to the nerve-centres supplying the uterine arteries, and perhaps the uterine

muscular fibres. The gently invigorating, not exhausting them, enabled nature to overcome the difficulty, and so to cure the disease.

In a few cases, where nature has been greatly below par, I have found ten-drop doses of rectified spirits of wine in an ounce of water, and combined with local tonics, useful; but even this small quantity must be watched in weak subjects, as cumulative doses cause congestive headache and other bad symptoms.

The question we must ask ourselves is this, Does the glass of wine or bitter ale benefit the exhausted business man, the hard-reading man, the physically-exhausted fast-living man, the debilitated invalid? In all these conditions the stomach is unequal to its natural task. The stimulus of ordinary food fails to produce a continued healthy flow of gastric juice. An exudation of mucus is incited, which as a ferment gives rise to heartburn, nausea, acid and acrid eructations, and often congested or bilious headache. If the furnace into which the fuel is introduced be out of order, how can the vast machinery dependent thereon for supplies be kept in repairs or exercise its several functions. It is obvious that the state of the stomach is one of disease. The brain-centres must be terribly shattered before a heavy day's work shall cause the parts bearing the strain to withdraw the natural amount of nervo-electricity which ought to be at the service of the stomach. In other words, it takes more than a hard day's work to render a healthy stomach atonic and sick. Such a state of

disease requires a remedy. Is that remedy alcohol? As we have seen, alcohol does increase the circulation, and, consequently, *pro tem.*, the amount of nervo-electricity or vital force generated. The augmented general and local circulation cause a temporary flow of gastric juice, and create an appetite. But this result is obtained at the expense of the already exhausted capital, and is unsatisfactory, inasmuch as it only secures one of the ends in view. It does resuscitate *pro tem.*, it does secure to the stomach a full meal—but it does not give the power necessary to resolve and assimilate that meal, it does not enable the stomach to appropriate it for the building up and strengthening the tissues, and especially the exhausted nerve-centres. If it did, we should not have the patients in the sad condition which they are, obliged to take the remedy daily, and for ever, and then failing at last. The stomach itself is not at all improved after the meal artificially swallowed by means of alcohol. The furred tongue does not clean, the dry, flabby tongue does not moisten and become healthy. The dryness of the fauces and the longing for more drink is not abated, but surely increases until drinking becomes a mania. The exhausted nerve-centres artificially forced to work beyond their strength need a long period of rest, and the after-dinner nap is generally the accompaniment of the meal washed down with stimulants.

Thus it is only fair to assume that a drug which fails to cure, and which intensifies and confirms the disease is not the right remedy. If so, alcohol is not

the remedy to promote a healthy digestion and to strengthen and tone the digestive organs. The exhibition of local tonics, the introduction of such food as the stomach can digest, the cessation from injudicious strain, a period of rest sufficient to allow the resuscitation of the enfeebled nerve-centres, and a general gentle bracing stimulant in the shape of sea-breezes, or country and mountain air, must suggest themselves to the thoughtful mind as the correct remedies for indigestion, and far preferable to the heating, exciting, and bewitching hallucinations of alcohol.

What then is the therapeutic value of alcohol? It is too general a stimulant to be of lasting service in most diseases. When a sudden spurt is necessary, that is when the sudden stimulus will overcome an obstruction, and without any derogatory symptoms following, alcohol in proper dose is no doubt a remedy. Alcohol and ammonia will stimulate the heart in syncope, the latter more powerfully than the former. Ammonia inhaled will powerfully stimulate both heart and lungs. Cold water sipped and sprinkled on the face and chest will by reflex action stimulate the heart in syncope. But the most effectual remedy, especially in a man, is to bend the back and put the head between the knees, until the patient is red in the face. This increase of blood to the brain-centres supplying the heart, and the reflex action induced to overcome the momentary stagnation in the circulation, soon relieve the syncope.

Alcohol and camphor, both general stimulants, may

cure a cold in its first stage by stimulating nature to throw it off by the skin and kidneys. But both aggravate the evil if the cold be settled and confirmed. Alcohol will sometimes relieve an atonic diarrhoea by increasing the circulation in the atonic bowel; but this is uncertain, inasmuch as the diarrhoea may be caused by inflammation or irritation of the lining membrane of the bowel, which alcohol would intensify; or the first doses may fail as general stimulants to overcome the evil, and leave the diseased part more feeble and lifeless than at first. It is wise to give a more local tonic than alcohol, as arsenic, mercury, cayenne, camphor, catechu, kino, etc., all gentle stimulants in proper doses.

It is obvious from the examples quoted, and they might be multiplied, that alcohol is harmful in acute inflammations. It intensifies and extends the area of inflammation by driving more blood to the already blocked and distended vessels. The idea hitherto held by medical men has been to overcome the obstruction by brute force, by alcoholic stimulation. And occasionally, when the obstruction has not been very great, this method, or others employed at the same time, may have succeeded. But who can count the numbers sent out of the world before their time by this tender treatment! It is like the strong out-works of a fortified city, they may be taken at once by storm—but how often is it otherwise, and what terrible wear and tear does even success entail! The same holds good in speaking of subacute congestion, or of any disease where there is stagnation or blocking.

in any part of the circulation. We have seen how detrimental alcoholic stimulus is in bronchitis and other chest diseases, stimulating blood to and irritating the mucous membranes of the bronchial tubes and larynx. It must be obvious to all, after reading the illustrations quoted, that alcohol, excepting in small doses, is useless in dyspepsia, and that even then, if given habitually, or if given in the amount ordinarily known as moderate drinking, it but intensifies the disease, thickening the coats of the stomach, or causing a burning congestion and dryness of the mucous membrane of the upper portion of the alimentary canal. Because of its stimulating action, and because it so often causes the flow of fermentative mucus and acidity of the stomach, it is most injurious in rheumatic and gout diseases. It increases the pain in the swollen, blood-blocked joints, and adds, by creating acidity, to the poison which produces these diseases.

Alcohol cannot be useful in any kind of fits, caused as they are by exhaustion, and by irregularity, often too strong blood-pressure, of the circulation. Alcohol cannot be useful in mental diseases, as it is one of the most powerful excitors of the brain. In fevers it but increases the fever virus, by preventing its elimination, and so causing a cumulation of the same; while in small doses it is physiologically inert, and to give it in large doses is simply butting one poison against the other, leaving nature to take chances. In chronic diseases it is of little value; the proper treatment in such cases is to specially attend to the

stomach, so as to secure good digestion and assimilation of food taken, thus imparting force and strength, and at the same time to give medicines which act locally on the diseased parts.

In chloroform poisoning, and doubtless in some other cases of sedative or true narcotic poisoning, as aconite, belladonna, chloral-hydrate, snake poisons, etc., proper doses of alcohol, enough to overcome the great depression, or to keep up the heart's action until the sedative be eliminated from the blood, give a good chance of life. Large doses must not be given, or they will easily exhaust the already debilitated system, and simply alter the mode of death.

Alcohol is sometimes useful as an evaporating lotion; as a stimulant and antiseptic applied externally it is efficacious in healing incised wounds. Looked at philosophically and impartially, alcohol is certainly limited in its extent as a medicinal agent.

*Resumé.*—From the above facts and reasonings we may, I think, conclusively draw the following deductions:

1. Alcohol burns; it raises the temperature, but afterwards lowers it  $1^{\circ}$  to  $5^{\circ}$ .

2. Alcohol does not, unless in concentrated and large dose, precipitate the pepsin of the stomach, and even this interferes comparatively little with digestion, as the precipitated pepsin is again soluble in water.

3. There is no proof as yet to show that alcohol materially interferes with the blood by direct action on the corpuscles. The corpuscles, in common with the whole body, are affected by the physical exhaustion induced by the drug.

4. Alcohol stimulates all parts of the alimentary canal with which it comes into contact. But a depression follows the exalted stimulus and the withdrawal by absorption of the alcohol.

5. Alcohol stimulates the circulation, and for a time stimulates the nerve-centres to increased activity, and to the elaboration of more vitality or nerve-force. This extra strain exhausts the nerve-centres, even as an extra strain in response to the will. But while the extra strain in answer to the dictates of the will elaborates force, and applies it to a purpose, the force elaborated by the alcohol is for the most part lost, just as the steam escaping from a tea-kettle. The capital is drawn upon, and the force lost in pleasurable sensations and phantom dreams.

6. The remedy for prolonged strain in mechanical or mental labour is rest, and at a certain point sleep. So the remedy for alcoholic exhaustion adopted by nature is rest or lowered vitality, and, at a certain point, drunken sleep, or narcotism.

7. Alcohol at first stimulates local nerve-centres, and if a small dose in doing so relieve distress, it is the right remedy; but large doses, or doses which do not quickly relieve, only increase the mischief.

8. In those not habituated to the use of alcohol the drug acts in a more potent manner—in weakness and lowered vitality—than when the person is strong and healthy, *i.e.* the effect of a particular dose tries most severely the weak and debilitated.

9. A larger amount of alcohol can be taken in a given time in small and continued doses than in

large doses, inasmuch as the strain upon the nerve-centre is less severe at any given time.

10. The power of alcohol may be lessened by giving other stimulants at the same time, because the nervo-electricity is more widely distributed by the different stimulating agents.

11. In fevers large doses of alcohol exert little or no physiological effect until they are sufficiently potent to overcome the depressing influences of the fever virus.

12. If alcohol be taken by the debilitated person, and at the same time the stomach be severely irritated by indigestible foods or potent local tonics not rapidly absorbed, epileptic convulsions often result.

13. In diseases where a high temperature increases the waste of the tissues, alcohol, by reducing the temperature, and overcoming other physiological influences, lessens the waste, but at the same time devitalises, and renders it more difficult for nature to rid herself of the poison.

14. If there be any obstruction to the circulation, the exhibition of alcohol will induce hyperæmia of the lungs, and consequent exudation of frothy phlegm, and even blood.

15. Alcohol is a severe stimulant, a large dose abstracting the nervo-electricity, and devitalising or perhaps even injuring, the vital nerve-centres. Doses taken more gradually devitalise the nerve-centres, excepting the medulla, and the person is narcotised until all or the greater part of the alcohol is eliminated, and until the exhausted centres are rested.

16. Persons may become habituated to the taking

of alcohol, but they will most probably suffer in the course of time, unless fortified to resist and overcome its effects by the invigorating stimulus of bodily exercise and fresh-bracing air.

17. The habitual use of alcohol either renders the necessity for starchy, fatty foods less, and so blunts the appetite, or the appetite may be maintained and the fats stored up in the tissues and viscera of the body, causing unhealthy fatty degeneration.

18. The stimulus of the alcohol to the brain-hemispheres and other parts is so severe that the will and reason are dethroned, and the person is simply the slave of the god, for the most part unconscious and irresistibly impelled to implicit obedience to his dictates.

19. Alcohol does not give life; the futile energy and heat which it does liberate by its combustion being sadly too insignificant and far outweighed by its powers of exhausting. It does not give life, but it appropriates the life that is, and may in certain cases be used with benefit, if in proper and scientific doses. Even as the man with a capital may speculate with a portion, providing he leave enough untouched to carry on the business to which he trusts for support, in case of failure in his speculations.

20. Alcohol directly applied will precipitate albumen and destroy the vitality and irritability of exposed nerve-fibres in recent wounds, thus forming a protective coat for the deeper parts to heal, and at the same time accelerating the same by the absence of pain and irritation. Might it not be advantageously applied locally in major surgical operations?

And now, briefly in conclusion, let us view our position as a profession. We are attacked and accused as a body, not only by the teetotallers, not only by the clergy, but by the public at large the blame is thrown upon us, that we in our professional capacity have ordered alcoholic elixirs as life-givers, as strength-revivers, as most valuable medicines, as indispensable foods, that we have forced teetotallers to break their vows, taught water and milk drinkers to sip the fascinating cup, and so mightily influenced the nation in its appetite for drink. And although some may have more discretion, science, and moral goodness than to force their patients to drink, yet I lament and grieve that in many cases the accusations of the public are but too true. Do we order our patients to give their children sweetmeats ? do we name the varieties, recommending one in preference to another, ordering them unmindful of the damage they must inflict, simply because we wish to please the little ones, and because sweets, as heat-givers, are food ? Do we forget the responsibilities committed to us on receipt of our diplomas, skilfully to administer toxicant drugs, by throwing the responsibilities on the patients and ordering Powell's Balsam of Aniseed, Dr. Browne's Chlorodyne, Bunter's Nervine, to be taken at their own discretion ? And shall we inflict a curse on the nation by making the publicans our chemists ? Is there a man in the medical profession who would dare to order his patients to take spirits of wine whenever they felt they needed it ? And wherein consists the difference in ordering

elixirs composed of more than half of alcohol, and two-thirds as strong as rectified spirits, and likewise adulterated with fusel-oil and other stimulants and narcotics without end? If there be danger in trusting spirits of wine to the patients, is there not also danger in entrusting elixirs of unknown strength and of unknown ingredients, simply because they contain alcohol? Each duly qualified practitioner has the right by law entrusted to him to prescribe any toxicant drug, and among them alcohol. But with the right comes the responsibility, bearing upon each one to prescribe scientifically such doses as periodically repeated for a longer or shorter time shall assist nature in overcoming disease. And in this province of duty the public have no right to interfere. But when any of our members forget that duty, and recklessly, unscientifically, and often simply to pander to and please their patients, order such harmful potions as medicines or otherwise, so throwing the responsibilities entrusted to them on to the shoulders of their patients, the public have a perfect right to criticise. To prescribe alcohol alone, or with other medicines in medicinal doses, is scientific and philosophical, and cannot lead to harm. To order and to compel patients to partake of adulterated alcoholic elixirs and of unknown strength and composition, and for the most part at their own discretion, is unscientific, unphilosophical, and dangerous.

THE END.